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OBSERVATIONS ON BLOOD GROUPING AND BLOOD TRANSFUSION *

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DUE to the increasing importance of blood transfusion as a therapeutic measure, blood grouping has become one of the commonest and one of the most important laboratory procedures. During the last few years, many articles have appeared describing the occurrence of irregular iso-agglutination reactions. Landsteiner and Witt¹ maintain that many of these irregular reactions are due to technical errors, some to pseudo-agglutination, others to cold agglutinins and, in rare instances, to anomalous iso-agglutinins as in the case cited by Ottenberg and Johnson.² Landsteiner and Levine³ showed that the irregular agglutinins which they found were not sufficient to cause a post-transfusion reaction in five patients. However, Guthrie and his co-workers⁴ consider the irregular iso-agglutinins which they found as equivalent to the ordinarily accepted ones. They believe that these iso-agglutinins are missed by the ordinary routine tests for blood grouping and that many of the post-transfusion reactions are due to the incompatibility of the bloods with respect to these newly described iso-agglutinins.

At a hospital where the services are as active as those at Bellevue, many blood transfusions are performed. As most of the patients are financially unable to afford a professional donor, members of the family and their friends are called to act as donors. This necessitates a great number of blood grouping examinations. Thus we are in a position to make many interesting observations which may throw some light upon the importance of these irregular reactions.

Ten thousand bloods were examined for groupings during the period beginning December, 1925, and ending July 1, 1929. The bloods were classified according to the Jansky⁵ nomenclature. In this paper we shall use the nomenclature recommended by Landsteiner⁶ and accepted by the Hygiene Committee of the League of Nations.

We use the open macroscopic method of Vincent⁷ for determining the group to which an individual blood belongs. This, Ottenberg⁸ claims, is the method of choice for a routine laboratory. We use defibrinated instead of citrated blood, since Grove⁹ showed that sodium citrate exerts a distinct inhibiting action upon the agglutination of certain Group B cells. The sera used for testing are collected from the bloods that have already been exam-

* Read before the New York Pathological Society, November 21, 1929.

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ined in the laboratory. The bloods are centrifuged and only the clear yellow sera are kept. All Type A sera are pooled as are also Type B. The composite sera are tested against known red cells. By this method we are assured that our testing sera have a fairly high titre of iso-agglutinins, and are not anomalous. If an anomalous sample of serum is overlooked, it is diluted by being mixed with normal sera of the same type. The sera are kept in properly labeled dropping bottles in the ice-box at 0° C. When they are to be used they are taken out and kept at room temperature for a short time. Sera collected and kept in the manner indicated remain active for a fairly long time.

I. *Frequency of blood groups.*

The relative frequency of the four groups in our series compares very closely to that reported by other American investigators as can readily be seen in Table I.

TABLE I

Investigator	Year	No. of Bloods	O	A	B	AB
Hektoen ¹⁰	1907	75	46.4	43.4	7.2	3.0
Moss ¹¹	1910	1,600	43.0	40.0	7.0	10.0
Karsner ¹²	1918	1,000	46.2	42.4	8.3	3.1
Culpepper ¹³	1921	5,000	44.5	36.0	14.3	5.2
Buchanan and Higley ¹⁴	1921	1,536	46.9	40.8	8.5	3.6
Ottenberg ¹⁵	1921	286	44.0	42.0	12.0	2.0
Snyder ¹⁶	1929	20,000	45.0	41.0	10.0	4.0
Tiber.....	1929	10,000	45.6	36.4	13.5	4.5

When compared with the results of European investigators, we find that our figures agree fairly well with those given for the Southern European races. Hirschfeld and Hirschfeld,¹⁷ in an interesting article pertaining to the distribution of blood groups among the various races, show that Group A is more prevalent among the Europeans and Group B among the Asio-African races. The countries lying between Asia and Central Europe show an intermediate distribution. Table II shows the English heading the list with 43.4 per cent. Group A and 7.2 per cent. Group B. Passing to the people east and south of England, Group A decreases and Group B increases, until we get to India where Group A is but 19 per cent., and Group B 41.2 per cent. Since most of the patients treated at Bellevue Hospital are descendants of Southern Europeans we can readily explain our findings.

II. *Results of testing red cells with known type A and B sera.*

In our series there were only fifteen bloods in which the agglutination of the red cells was questionable with our testing sera. That is, the reaction was not as strong as is usually seen and the individual performing the test felt that a check was indicated. In these cases he requested that a cross-

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TABLE II

	O	A	B	AB
<i>European</i>				
English.....	46.4	43.4	7.2	3.0
Italian.....	47.2	38.0	11.0	3.8
German.....	40.0	43.0	12.0	5.0
Austrian.....	42.0	40.0	10.0	8.0
Greek.....	38.2	41.6	16.2	4.0
<i>Intermediate</i>				
Arab.....	43.6	32.4	19.0	5.0
Turk.....	36.8	38.0	18.6	6.6
Russian.....	40.7	31.2	21.8	6.3
Jew.....	38.8	33.0	23.2	5.0
<i>Asia-African</i>				
Negro.....	43.2	22.6	29.2	5.0
Indian (Hindu).....	31.3	19.0	41.2	8.5

agglutination be done before the transfusion. It is well known that in anaemic bloods the macroscopic method may be difficult to read. Clotted bloods should not be typed by this method for they too may give questionable results. It is possible that some of these fifteen bloods were from anaemic persons and that others were clotted, but the operator took it upon himself to do the tests in spite of this. Quite likely the more accurate test tube method would have precluded this difficulty.

We may conclude that the grouping of the red cells was performed without difficulty in all but fifteen cases. These cases were questionable because the macroscopic method was used on bloods that were probably anaemic or clotted.

III. Results of testing sera with known red cells.

In some cases the serum as well as the red cells were tested. The exact number in which this was done is not known, as no record was made where the serum and cells gave the required tests. In only six cases recorded in Table III, the serum was found to give reactions which were different

TABLE III

Name	Group to Which Cells Belong	Action of Sera of Same Patients
C.....	O	Agglutinates B but not A cells
F. McV.....	O	Agglutinates B but not A cells
R.....	A	Does not agglutinate A or B cells
D.....	A	Does not agglutinate A or B cells
J. F.....	AB	Agglutinates B cells
J. H.....	A	Does not agglutinate A or B cells

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from those usually given by the serum corresponding to the group to which the cells belong; *e.g.*, the cells of patient C were not agglutinated by the known type A and B sera, but her serum agglutinated the cells of a sample of blood belonging to Group B, but not one of Group A.

Before reporting the finding of atypical sera, it is necessary to make exhaustive tests with many different samples of red cells of the same and different groups under varying conditions and to make thorough quantitative studies of each of the sera in question.^{1, 18, 19} Since our sera were tested by the macroscopic method alone with only one, or probably two, specimens of red cells, and as no quantitative studies were made, we are unable to make any definite statement about these sera other than to say that they were encountered. It is possible that these sera were not atypical. It is a well-

TABLE IV

Name	Group	Remarks
Mrs. E.....	O}	
Mr. E.....	O}	Serum agglutinates cells of Mrs. E.
Wm. McE.....	A}	
J. F.....	A}	Serum agglutinates cells of Wm. McE.
M. McL.....	O}	
H. M.....	O}	Serum agglutinates cells of M. McL.
J. D., Sr.....	O}	
J. D., Jr.....	O}	Serum agglutinates cells of J. D., Sr.
R. O'C.....	O}	
M. O'C.....	O}	Serum agglutinates cells of R. O'C.

known fact that many red cells are weakly agglutinated and that sera vary in their agglutinin titre. Since our tests were made by the macroscopic method, it is possible that the agglutination was so weak that it could not be seen by the naked eye.

In view of the fact that six so-called atypical bloods were encountered by testing the sera of only a comparatively small number of our cases, we may assume that many similar sera passed unnoticed.

IV. Irregularities discovered by cross-agglutination.

Of the small number of bloods which were cross-matched, in only five cases was it found that although the donor and recipient belonged to the same group, the cells of one were agglutinated by serum of the other.

In this series the donors were discarded and new donors obtained. It is unfortunate that these bloods were not studied more thoroughly. How many similar bloods passed unnoticed, we are unable to say, but we have reason to believe that many were used in our series of transfusions.

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V. Study of blood transfusion records.

A study of the blood transfusion records at this hospital was undertaken in order to determine what effect irregular bloods, similar to those described above, had on the outcome of the transfusion. During the three and one-half-year period ending July 1, 1929, 1,467 blood transfusions were performed. The majority of these were done by the Lindeman²⁰ syringe method and a few, on infants, by the indirect citrate method. There were but 2 deaths in this series: A woman twenty-four years old, and a child of two months.

CASE I.—M. G., female, married, twenty-four years of age, United States housewife. Admitted because of vaginal bleeding and abdominal pain. Diagnosis of post-abortal salpingitis, secondary anaemia. A blood transfusion was deemed advisable because of the severity of the anaemia. Patient typed in the routine manner and was classified as a Group O. Her husband, who was used as donor, had been reported as belonging to Group O also. The transfusion was given and before 400 cubic centimetres were injected, the patient developed cyanosis, dyspnoea, cough and a severe headache. The transfusion was concluded and the patient returned to the ward immediately. The patient died fourteen days later from anuria.

Due to the reaction of the patient during the transfusion, the husband's blood was retyped and found to belong to Group A and not Group O, as previously reported.

CASE II.—H. M., male, age, two months. Admitted because of malnutrition, dehydration, secondary anaemia; making an emergency blood transfusion necessary. The child's blood was typed and found to belong to Group A. The mother's blood belonged to Group O. Inasmuch as the mother could not afford a professional donor, it was decided to chance her as the donor because of the critical condition of the child. The child died about two and one-half hours after the transfusion with all the signs and symptoms of a typical transfusion death.

Autopsies were performed on both these patients and the findings will be reported at a later date.

These two deaths are readily explained: The first resulted from the use of an incompatible blood, due to a technical or clerical error, and the second was caused by incompatibility of the bloods due to the use of a so-called universal donor in an anaemic child.²¹

From these facts we may conclude that the differences noted in the serum of some individuals within the same group, as determined by typing the red cells, are of a minor character and are not sufficient to cause death even if such an individual is used as a donor or recipient. Landsteiner and Levine³ observed "uneventful transfusions in five patients whose sera agglutinated distinctly the cells of the respective donors, some of the sera acting even at 37° C."

In order to emphasize this point, we searched the literature for statistics on blood transfusions.

Bernheim²² in 1917, collected reports of 800 blood transfusions from twelve surgeons and found a total of ten deaths; no tests for compatibility had been performed in three cases, one was typed wrongly, four died of cardiac failure and two from anaphylactic shock. Pemberton²³ in 1919,

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reported three deaths in 1,036 blood transfusions at the Mayo clinic; all resulting from the use of incompatible bloods due to technical or clerical error in the laboratory. Copher²⁴ in 1923, reported two fatalities in 245 transfusions; in one case the patient matched perfectly with the donor, but died eleven days later. The second death resulted from the use of an incompatible donor following an error in the laboratory. Kordenat and Smithies²⁵ in 1925, reported no deaths in 764 transfusions. Brines²⁶ in 1928, reported no deaths in 2,500 transfusions. The Blood Transfusion Service of the British Red Cross Society²⁷ reported five deaths in 3,430 blood transfusions; three were due to wrong types, one occurred in a man with

TABLE V

Investigator	Year	Tests	No. of Transfusions	No. of Deaths	Cause of Death			
					Wrong Type	Primary Dis.	Heart Failure	Unknown
Bernheim ²² . . .	1917	Grouping	800	10	4	0	4	2
Pemberton ²³ . . .	1919	Grouping	1,036	3	3	0	0	0
Copher ²⁴	1923	Grouping, x-matching	245	2	1	0	0	1
Kordenat and Smithies ²⁵ . . .	1925	Grouping..	764	0	0	0	0	0
Brines ²⁶	1928	Grouping..	2,500	0	0	0	0	0
Brit. Red Cross Soc. ²⁷ . . .	1929	Grouping..	3,430	5	3	1	0	1
Tiber.	1929	Grouping..	1,467	2	2	0	0	0
Totals.			10,242	22	13	1	4	4

advanced malignant disease who died during an attack of syncope while being transfused, and the fifth in a woman whose blood was compatible with the donor but she died eleven days later of anuria.

Table V shows that in a total of 10,242 blood transfusions there were but twenty-two deaths: incompatibility of the bloods being the cause of thirteen deaths, heart failure four, the primary disease one and unknown cause four. Whether a mistake was made in grouping the bloods of the last four cases one cannot decide, because these bloods were not sufficiently studied.

In Pemberton's²³ series there were twelve instances in which there were group reactions due to errors in the testing of the bloods. In three of these the symptoms were not recognized during the transfusion, the patients receiving the full 500 cubic centimetres with resulting death. In the nine others, the symptoms were recognized and the transfusion stopped after the injection of 50 to 100 cubic centimetres with no mortality. Thus if a patient receives 500 cubic centimetres of incompatible blood, death follows, whereas

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the injection of only a small amount results in a severe reaction from which the patient usually recovers.

Guthrie and his co-workers⁴ claim that the irregularities in blood grouping are due to heretofore unrecognized iso-agglutinins of the same order as those usually accepted. If this is so we should expect a higher mortality than we actually obtained in our series and those collected from the literature. In view of the fact that the total mortality is but 0.39 per 1000 blood transfusions, with the present methods of blood grouping, we may conclude that these methods are efficient for the purpose of determining the compatibility of donors and recipients.

SUMMARY

Ten thousand bloods were examined for grouping by the Open Macroscopic method of Vincent. Forty-five and six-tenths per cent. fell into Group O, 36.4 per cent. Group A, 13.5 per cent. Group B and 4.5 per cent. Group AB. The material used for testing these bloods consisted of pooled specimens of Group A and B sera. The grouping of the red cells was without fault in 9,985 bloods. Fifteen gave questionable agglutination because they were either clotted or very anaemic. The sera of a small number were tested with known red cells and it was found that in six cases the typing did not check with the results obtained by typing the red cells. (See Table III.) In five cases, in which the donor and the recipient were of the same group, there was agglutination when the bloods were cross-matched. In 1,467 blood transfusions there were but two deaths: One as a result of an error in technic and the second as a result of the use of a so-called universal donor. Ten thousand two hundred and forty-two blood transfusions were collected from the literature with twenty-two deaths from all causes in this series. Thirteen were due to wrong types, one to primary disease, four to heart failure and four to unknown cause.

CONCLUSIONS

1. The Open Macroscopic method of Vincent is efficient for determining the blood group of recipients and donors.
2. Testing sera should consist of pooled specimens of Group A and B sera.
3. Grouping by this method should be determined by testing the red cells alone.
4. The classification of bloods into four groups is sufficient for the purpose of blood transfusion.
5. The death rate for blood transfusions is 0.39 per thousand.

BIBLIOGRAPHY

- ¹ Landsteiner, K., and Witt, D. H.: *Jour. Immunol.*, vol. xi, p. 221, 1926.
- ² Ottenberg, R., and Johnson, A.: *Jour. Immunol.*, vol. xii, p. 35, 1926.
- ³ Landsteiner, K., and Levine, P.: *Jour. Immunol.*, vol. xvii, p. 1, 1929.
- ⁴ Guthrie, C. G., and his co-workers: *Bull. Johns Hopkins Hospital*, vol. xxxiv and vol. xxxv, 1924-25.

ARTHUR M. TIBER

- ⁵ Jansky, J.: Sbornic Klinicky, vol. viii, p. 85, 1907.
- ⁶ Landsteiner, K.: Personal communication.
- ⁷ Vincent, B.: J. A. M. A., vol. lxx, p. 1219, 1918.
- ⁸ Ottenberg, R.: J. A. M. A., vol. lxxix, p. 2137, 1922.
- ⁹ Grove, E. L.: Jour. Immunol., vol. xii, p. 251, 1926.
- ¹⁰ Hektoen, L.: Jour. Infect. Dis., vol. iv, p. 297, 1907.
- ¹¹ Moss, W. L.: Bull. Johns Hopkins Hospital, vol. xxi, p. 63, 1910.
- ¹² Karsner, H. T.: J. A. M. A., vol. lxx, p. 769, 1918.
- ¹³ Culpepper, W. L.: Jour. Lab. and Clin. Med., vol. vi, p. 276, 1921.
- ¹⁴ Buchanan, J. A., and Higley, E. T.: Brit. Jour. Exp. Path., vol. ii, p. 247, 1921.
- ¹⁵ Ottenberg, R.: Jour. Immunol., vol. vi, p. 363, 1921.
- ¹⁶ Snyder, L. H.: Blood Grouping in Relation to Legal and Clinical Medicine. Wilkins and Wilkins, 1929.
- ¹⁷ Hirschfeld, L., and Hirschfeld, H.: The Lancet, vol. ii, p. 677, 1919.
- ¹⁸ Mino, P.: Münch. Med. Wchnschr., vol. lxxi, p. 129, 1924.
- ¹⁹ Lattes, L., and Cavazzuti, A.: Jour. Immunol., vol. ix, p. 407, 1924.
- ²⁰ Lindeman, E.: Am. Jour. Dis. Child., vol. vi, p. 28, 1913.
- ²¹ Levine, P., and Mabee, J.: J. Immunol., vol. viii, p. 425, 1923.
- ²² Bernheim, B. M.: Blood Transfusion-Hæmorrhage and the Anæmia. J. B. Lippincott Company, Phila., 1917.
- ²³ Pemberton, J. de J.: Surg. Gyn., and Obs., vol. xxviii, p. 262, 1919.
- ²⁴ Copher, G. H.: Arch. Surg., vol. vii, p. 125, 1923.
- ²⁵ Kordenat, R. A., and Smithies, F.: J. A. M. A., vol. lxxxv, p. 1193, 1925.
- ²⁶ Brines, O. A.: Arch. Surg., vol. xvi, p. 1080, 1928.
- ²⁷ Witts, L. J.: Lanceet, vol. i, p. 1297, 1929.

RELATION OF PROTEIN DIET TO THROMBOSIS

THE IMPORTANCE OF BLOOD COAGULABILITY AND DIETARY
TREATMENT IN THROMBOSIS AND HÆMORRHAGIC CONDITIONS

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AT VARIOUS times since 1921, we have presented evidence of the relation of food intake to blood coagulability, pointing out the increased coagulability following protein intake and the lack of such effects with carbohydrate or fat.¹ For the last four years the writer has made use of this knowledge in the treatment of different forms of hæmorrhagic diseases, good results following the use of frequent protein feedings throughout the day. Many cases of frequent and repeated bleedings show a great disposition for such bleeding to take place four hours or more after the last preceding meal, when the protein effect has worn off.

A closer analysis of this protein effect in 1928² led us to the conclusion that it was intimately related to a more rapid platelet clumping and lysis which takes place at such a time, and that rather strenuous exercise or adrenalin injection may produce similar effects on the blood coagulability and platelets. Since the onset of thrombosis is usually based on a platelet clumping and disintegration in the stagnant venous blood, and since so frequently one sees it appear at about the same time that the patient is put on a full diet and allowed out of bed, we suggested in 1927³ that damage might result from the protein in the diet for the first two weeks after operation, termination of pregnancy, or acute febrile disease.

Recently Barcroft, Kugelmass and Stanley-Brown⁴ have presented the results of studies on blood coagulability in thrombosis, embolism, and hæmorrhagic states, based mainly on our past work. They show the beneficial effects of such dietary procedures as have just been mentioned. Their results are definite and conclusive as to the influence of diet on coagulability, showing that one can change this property of the blood almost at will. The diets listed in detail by them should prove very useful, although in hospitals having a dietitian great variability is allowable so long as proper attention is paid to the protein content.

When it comes to an application of their methods of studying patients to determine which should receive dietary treatment, it will be found that very few hospitals will be able accurately to carry out the tests on the blood because of technical difficulties. It becomes necessary, therefore, to lay down certain principles for the general handling of such classes of cases as are known to be prone to embolism or thrombosis. These classes include cases undergoing (a) trauma with considerable tissue mutilation; (b) surgical

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operations, especially intra-abdominal; (c) parturition; (d) acute febrile diseases, especially pneumonia and typhoid fever; (e) cardiac decompensation; and (f) phlebitis. Before attempting to specify a general line of prophylaxis against thrombosis in these conditions, one further point should be stressed.

In post-operative, post-partum, and post-febrile states, it has been found by a number of investigators that the platelet count, which suffers a rather severe depression during fevers and parturition, begins to rise soon afterwards, reaching a peak on the eighth to eleventh day after the fever subsides, or after childbirth or operation. This peak usually shows a platelet count of almost twice the normal. A subsidence back to normal takes place in the subsequent four to five days. Reimann⁶ observing the platelets in pneumococcus infections, found that they fall 40-50 per cent. during the febrile period, but begin to rise again as the fever falls, to reach a maximum on the twelfth to fourteenth day approximately double the normal number. Port and Akiyama⁷ had noted a similar behavior of the platelets in pneumonia, erysipelas and scarlet fever, while Helber⁸ observed the marked rise in the week succeeding the pneumonia crises and by the eighth day of normal temperature following typhoid fever. Lee, Minot and Vincent⁹ found after splenectomy that the platelets were very large in size and doubled or tripled in number, and that thrombosis was a frequent sequel of this operation. Hueck¹⁰ describes a decrease in number of platelets for the first five days after various operations, with a rise much above normal on the eighth to the eleventh day. Others who have observed the rise following acute infections are Gram¹¹ and Beck.¹²

This platelet rise thus takes place just at the time most patients of the above classes are being allowed up for mild exercise and at the time when full diet is permitted (and often encouraged to quicken recuperation). Thus we have a period when all factors favoring thrombosis are at a maximum: the platelets are greatly increased; increased protein intake increases their tendency to clump and disintegrate; and this is further aided by the exertion of moving around; and finally the action of the sluggish circulation is intensified during the first few days of sitting up or getting out of bed. Aschoff⁵ in his lecture on thrombosis admirably discussed these various factors which tend to favor thrombosis.

To illustrate the importance of these factors, a few case histories are briefly abstracted below.

CASE I.—Woman, age thirty-eight years, was operated for uterine fibroids July 11. On the 23rd, *twelve days after the hysterectomy*, she developed left femoral thrombosis. No note as to diet.

CASE II.—Woman, twenty-seven years old, had an appendectomy on June 23 for acute appendicitis. Ten days later, July 3, she was changed from a liquid diet to full diet. The next day, July 4, she developed right femoral thrombosis.

CASE III.—Woman, thirty-five years old, underwent operation for uterine suspension and removal of the appendix on September 5. She was changed from liquid to soft diet on the 9th, and died suddenly from embolism on the 12th.

PROTEIN DIET AND THROMBOSIS

Barcroft, Kugelmass and Stanley-Brown, in the article referred to above, cite four of their cases in which thrombosis or embolism occurred, one on the sixth, one on the ninth, and two on the eleventh day post-operative. The embolism on the sixth day immediately followed the exertion of the patient arising from his bed to walk to the toilet. Most surgeons of long experience will agree that this period from ten to fourteen days after operation is most fraught with the dangers of thrombosis and embolism. It so often occurs just as the patient is ready to leave the hospital, or within a day or two after his return home.

On the basis of the facts and observation cited above, it would seem very advisable to keep all patients on a very low protein diet for the first two weeks following (a) operations, especially splenectomy or other operations within the abdomen or pelvis; (b) trauma, with much tissue mutilation; (c) child-birth; (d) acute febrile diseases, such as pneumonia, typhoid, etc.; (e) cardiac decompensation at all times, but especially with auricular fibrillation; (f) phlebitis at all times.

A high protein diet, with feedings every three to four hours, should be used in cases exhibiting a *haemorrhagic tendency*.

Following childbirth it is recognized that such restriction of diet may not always be advisable on account of its effect on milk production, but this can largely be alleviated by a generous supply of carbohydrates and fats.

BIBLIOGRAPHY

- ¹ Mills, C. A.: Jour. Biol. Chem., vol. xviii, p. 55, 1923.
- ² Mills, C. A., and Necheles, H.: Chinese Jour. Physiol., vol. ii, p. 219, 1928.
- ³ Mills, C. A., and Necheles, H.: Proc. Soc. Exper. Biol. and Med., vol. xxv, p. 195, 1927.
- ⁴ Barcroft, F. W., Kugelmass, J. Newton, and Stanley-Brown, Margarét: ANNALS OF SURGERY, vol. xc, No. 2, p. 161, August, 1929.
- ⁵ Aschoff, L.: Lectures on Pathology, Paul B. Hoeber, Inc., New York, 1924.
- ⁶ Reimann, H. A.: Jour. Exper. Med., vol. xl, p. 553, 1924.
- ⁷ Port and Akiyama: Deutsch. Arch. f. klin. Med., vol. cvi, p. 362, 1912.
- ⁸ Helber, E.: *Ibid.*, vol. Ixxxi, p. 316, 1904.
- ⁹ Lee, R. I., Minot, G. R., and Vincent, B.: J. A. M. A., vol. Ixvii, p. 719, 1916.
- ¹⁰ Hueck, H.: Deutsch. Zeitschr. f. Chir., Leipzig, vol. cxcii, p. 322, 1925.
- ¹¹ Gram, H. C.: Arch. Int. Med., Chicago, vol. xxv, p. 325, 1920.
- ¹² Beck: Monatschr. f. Kinderhielk, vol. xxix, p. 673, 1925.

EXPERIENCES WITH SODIUM AMYTAL AS A GENERAL ANÆSTHETIC *

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THE resistance by patients to the advice of surgeons that an operation is desirable or essential to health or life is an everyday feature of professional experience. The resistance is stressed in terms not of fear of the cutting, but of fear of losing consciousness through the medium of an inhalation anæsthesia. This is a fear engendered by conversation with those who have been operated upon. Friends and relatives rehearse the unpleasant phenomena which they suffered incident to breathing gas and ether. They tell of the smothering and strangling sensation and of the struggling and fighting against the fear of impending death. Prospective operatives often conclude that living with a disability is preferable to the subjugation of one's self to the mental agony which, while anæsthesia is being produced with noxious vapors, is said to be an eternity in passing.

The observation of Doctor Killian of Germany that "Consideration of the psychic condition of the patient is identical with the protection of the whole organism" is profound clinical truth. "Many patients squander their physical and psychic energies through anxiety over the operation"—which includes fear of the anæsthetic—"and not from the serious strain which the operation itself represents." Doctor Crile recognized the deep importance of these observations in his work on goitre. He stole his toxic thyroid patients to sleep.

Having direct bearing on the protection of the psychic, when surgical procedures are necessary, has been the introduction into the field of anæsthesia of Sodium Amytal. Sodium Amytal has evolved out of the study of barbituric acid derivatives since veronal was found a valuable hypnotic in 1903. Physiological chemists, pharmacologists and clinicians have experimented extensively since that time and have given to the profession allonal, medinol, luminal, amytal and other closely related drugs used mainly by internists. The possibilities in the surgical field have not been overlooked and the above drugs have been used with indifferent successes as anæsthetics.

The distinction of finding a barbituric acid derivative of signal worth in the induction of anæsthesia belongs to the Eli Lilly laboratories. For five years their chemists experimented with, perfected and used Sodium Amytal on animals. Doctor L. G. Zerfas and his associates in the Indianapolis City Hospital had the courage to try the drug on humans. Early this year Doctor Zerfas reported his achievement and successes on three hundred surgical cases. It is not hard to believe that in the future Doctor Zerfas will be

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justly honored as the individual who has made the outstanding contribution of modern times to the betterment and safety of anæsthesia.

The boon to the patient, lessening or abolishing the fear of inhalation anæsthesia, is the taking of Sodium Amytal in bed in his own room. The drug is given intravenously. Sleep comes quickly, like unto a child. When asleep the patient is moved to the surgery, operated upon and returned to his bed to sleep peacefully for hours without many of the distressing post-operative phenomena.

Our interest in Sodium Amytal was aroused early this summer at the Mayo clinic where it had been employed in over one thousand cases with happy results. Doctor W. J. Mayo spoke highly of its virtues. "Since the middle of August, I and my surgical associates of the Santa Barbara Clinic, Doctors Wills, Eder and Atsatt, have operated upon eighty-two cases with Sodium Amytal as an induction anaesthetic. I shall not enumerate the cases. The series include: leg and thigh amputations, arthrotomies, breast amputations, gastro-enterostomies, colostomies, acute and subacute appendectomies, haemorrhoidectomies, cholecystectomies, nephrectomies, prostatectomies, salpingectomies, perineorrhaphies, hysterectomies and hernioplasties."

Sodium Amytal is sodium iso-amyl ethyl barbiturate and is furnished by the manufacturing pharmaceutical house of Eli Lilly Company as a dry powder in ampules. With each ampule is a companion ampule of 10 cubic centimetres of sterile distilled water. With a sterile syringe the water is introduced into the ampule of powder. Several minutes are required for complete solution and escape of air bubbles. The solution must be absolutely clear and must be injected not later than fifteen minutes after its preparation. Only those trained in the methods and principles of anæsthesia should give the drug for the production of surgical anæsthesia. In our series of cases much credit for our results has been due to Doctor F. L. Grandstaff, who was recently associated with Doctor Zerfas in his work at the Indiana University Hospitals.

Our procedures in the induction of anæsthesia are: The patient is given by mouth chlorethane grs. 10 the night before and early in the morning of the operation as recommended by Doctor Lundy of the Mayo Clinic. One-half hour before operation morphine gr. 1/6 and atropine gr. 1/120 are given by hypodermic. Just before the operation Sodium Amytal is introduced intravenously at the rate of 0.75 to 1.0 cubic centimetres per minute. The amount of the drug to be given is determined by the weight of the person, by the age and by the metabolic rate. We have used from 7½ to 21 grains. A rough estimate is 1 grain to ten pounds of body weight. We have averaged 11 to 13 grains. Febrile patients and alcoholics took the maximum dose. Obese individuals seemed to require less of the drug per body weight than did the spare.

During the injection of the Sodium Amytal, blood-pressure readings were made frequently by an assistant. In our series the fall of pressure was

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found to be more marked than found by Doctor Zerfas and his associates. The fall seems to depend upon the patient's normal blood pressure. In cases with systolic pressure of from 130 to 170 millimetres the fall varied from 40 to 70 millimetres, whereas, in cases with pressures of from 90 to 130 millimetres, the fall ranged from 10 to 30 millimetres. In one case there was a fall from 170 millimetres to 50 millimetres, 120 points. It was also observed that hypnosis was more rapid with increased fall of blood pressure. In our series blood pressure returned to normal in from fifteen to thirty-five minutes.

Patients were soundly asleep in from three to five minutes. The passing from consciousness to sleep was like that of normal falling to sleep—calm, peace and oblivion. Many definitely snored. There was no excitement and no laryngospasm. In about fifteen minutes, the time occupied in giving the drug, there was general body relaxation with almost complete abolishment of the common reflexes with the exception of the pharyngeal. The respiration rate varied—slight increase or decrease—but always there was a decreased amplitude of movements of the chest. The action of the pulse was affected but little.

In the operating room before the incision was made, nitrous oxide gas was administered to the sleeping patient. Ether and ethylene were not used in our series. Although complete surgical anaesthesia can be produced by Sodium Amytal in large doses, it is probably not safe to use it. With the moderate doses we used we early learned that the patient moved his limbs or body when the incision was made and if gas was not given, movements continued when operative procedures were under way.

Sodium Amytal is perhaps technically not an anaesthetic. It does, however, produce sleep either with or without analgesia and anaesthesia. When the drug is used within its safety limits, the amount of supplementary gas needed was but from 60 to 85 per cent. of that usually inhaled.

The post-anaesthetic phenomena were pleasing to patients and to us. Patients slept more or less steadily for a period of from twelve to twenty-four hours. They were usually sufficiently conscious in four or five hours to drink water and often to void. At the end of twenty-four hours they were wide awake as from normal sleep with little or no memory of the events from the time of taking the Sodium Amytal until the complete awakening. During this period the absence of nausea, retching and vomiting was gratifying as was also the freedom from complaint of pain. The administration of fluids intravenously and subcutaneously was more easily done during this semi-conscious interval.

Post-operative gas pains were markedly lessened in the succeeding days. The bowels moved earlier, sometimes without aid. The non-striated musculature of the intestines was probably not paralyzed by the Sodium Amytal. There was no delirium in our cases. There was some increased restlessness which was controlled by small doses of morphine.

When patients were later able to talk about their operations they were

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enthusiastic in their praises of Sodium Amytal. Those who had been operated upon under gas and ether and again under Sodium Amytal contrasted their experiences to the detriment of the former and highly in favor of the latter. Two physicians who had seen the drug given insisted upon its use on themselves when they had to be operated upon.

In this picture of a new anaesthetic are there any disturbing shadows? There are a few. Except for one they are relatively of little importance. About 25 per cent. of our patients required catheterization. We tried to avoid this procedure by giving benzyl-benzoate. Two of our series had inability to raise mucus and one of them died from hypostatic œdema of the lungs—a man of seventy-seven upon whom a prostatectomy had been done. Lung œdema can be controlled by inhalation of carbon dioxide and oxygen as suggested by the Mayo Clinic. Sodium Amytal patients require special nursing from twenty-four to forty-eight hours. This is essential that possible delirium and restlessness may be controlled and to bring forward the tongue if it should fall back due to the relaxation of the throat which is said to happen occasionally. Special nursing adds to expense. Two patients had a rash which disappeared in twenty-four hours.

The one shadow which causes real concern is the occasional pronounced fall in blood pressure. Whether or not the fall is detrimental to a patient's welfare, immediate or remote, has not to my knowledge been determined. The rapid introduction of or the giving of too much Sodium Amytal is, of course, subject to control.

AN ANALYSIS OF ONE HUNDRED AND FORTY-EIGHT OPERATIONS FOR GOITER*

BY CHAS. GORDON HEYD, M.D.
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THIS paper presents an analysis of 148 operations performed for goiter upon 144 patients between January 1, 1927, and June 30, 1929. While the number is relatively small, it is sufficiently large to be fairly representative of the results to be expected together with the technical difficulties and complications which may be encountered in thyroid surgery.

During the same period of time in the Goiter Clinic at the New York Post-Graduate Medical School and Hospital we have examined 809 new cases and 1754 return cases—a total of 2563 cases of goiter. In the series presented herewith there were dispensary and private patients. After the clinic was started it became necessary to have a clinical classification of goiters in order that the cases might be properly classified and certain broad lines of therapy established. We decided upon a classification which was largely based upon thyroid function and have divided all goiters into three groups: (a) goiters with hyperthyroidism; (b) goiters with hypothyroidism, or approximately normal secretion, and (c) neoplastic goiters. Subdivisions of these three main categories give us a classification table as follows:

CLINICAL CLASSIFICATION OF GOITER

- A. Goiters with hyperthyroidism—hypersecretion or dysfunction.
 - 1. Goiter of adolescence.
 - Physiological gland with overfunction.
 - 2. Goiter of Graves' disease.
 - Pathological gland with overfunction and dysfunction.
 - 3. Goiter of adenoma—adenomatosis.
 - Pathological gland with overfunction.
- B. Goiters with hypothyroidism or normal thyroxin secretion:
 - 1. Simple, endemic goiter and colloid goiter.
 - Pathological gland—secretory activity normal or diminished.
 - 2. Goiter of adenoma.
 - Pathological gland—secretory activity normal or diminished.
- C. Neoplastic goiters and inflammatory goiters.

This classification is purely clinical and does not attempt to differentiate goiters upon a pathological basis although there is a definite parallelism between the various clinical subdivisions and the various types of pathological histology of the thyroid gland.

In so far as diagnosis and treatment are concerned it is immaterial whether one accepts the idea recently advanced that all goiters are varying phases of

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one continuous process or whether one adopts the more prevalent opinion that there are distinct subdivisions in the pathological classification of goiter.

In the last few years we have had three different pathologists, all expert, give their opinion upon our goiter material. When their reports are frankly analyzed it is found that there is a greater divergence of unanimity in pathological nomenclature than there is in a "workable" clinical classification. The introduction of iodine, both prophylactically and therapeutically, the extreme publicity given to it, its widespread indiscriminate use by the profession and in a wholesale manner by the laity, has tended to confuse the pathological picture with the clinical symptoms in many cases.

The classification of our 148 operations was as follows:

Hyperthyroidism	95 cases.
Hyperthyroidism of adolescence	3
Hyperthyroidism of Graves' disease *	56
Hyperthyroidism of adenoma	36
Hypothyroidism or normal secretion	45 cases.
Colloid goiters	24
Adenoma	21
Neoplastic, or inflammatory	8 cases.
Malignant goiters	5
Riedel's struma †	2
Tuberculosis	1

There is a very marked clinical difference in the typical case of hyperthyroidism of Graves' disease and the typical case of hyperthyroidism of adenoma. The hyperthyroidism of Graves' disease is an acute, overwhelming intoxication, apparently due more to a dysfunction of thyroid secretion than to a pure hypersecretion. It would seem to be primarily not a disease of the thyroid gland, but a loss of the normal control of thyroid secretion. The gland in Graves' disease per unit weight contains less iodine than the normal thyroid, yet the blood serum shows an excess of iodine. It may be deduced that there is a widespread change in the normal threshold of thyroid secretion and that as rapidly as thyroxin is elaborated by the gland in Graves' disease it is passed out into the circulation as an ill-formed, unstable thyroxin molecule. The result is a thyroid intoxication that is markedly different from that which occurs in adenoma. In Graves' disease the onset is rapid, ascribed to some great or passing psychic event, and from the time the symptoms begin until there is a fully developed picture of the disease the interval is usually less than a year. It occurs in relatively young people, with a large majority of the cases between the twentieth and thirtieth year. Exophthalmos is an outstanding feature, being present in 50 per cent. of the cases within the first year and in 80 per cent. of the cases within the two years. In our experience if the patient has received no iodine previous to operation it is the safest type of hyperthyroidism for surgery when controlled pre-operatively and post-operatively by iodine medication. By reason of the

* Three patients with Graves' disease had a second operation.

† One patient with Riedel's struma had a second operation.

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fact that it occurs in young subjects there is seldom any of the marked cardiac disability which is observed in the hyperthyroidism of adenoma. While the heart action in Graves' disease is markedly exaggerated and tachycardia is the most prominent symptom, yet the heart is ordinarily basically sound and is only "speeded up" and overworked. The completeness of recovery from Graves' disease after operation is dependent upon the length of time with which the patient has suffered from the hyperthyroidism. If the hyperthyroidism has been long continued there are very definite and permanent degenerative changes in the heart, brain, kidneys and liver, and while in the majority of cases symptomatic cure is complete there are some patients who suffer throughout the remainder of their lives with a tendency to tachycardia and an exaggerated reaction to any irritating or emotional stimuli.

We have a small group of goiter cases which have had a typical Graves' disease symptomatology, with basal metabolism +70, and who after operation acquire a normal basal metabolism, +11. There is no evidence of regrowth of thyroid; the only remaining symptom is a persistent tachycardia. This type of patient requires a prolonged convalescence before the tachycardia disappears, if it ever does. These patients are extremely prone to have a tachycardia on the slightest disturbing influence of environment, or finances, or of emotion. We have found that the post-operative administration of Lugol's solution, or sodium iodid, in small doses, five minims twice a day for two or three months, following operation, brings about a more rapid gain in weight, a marked slowing of the pulse and a more complete general physical improvement.

The convalescence after operation for Graves' disease is a much more delicately balanced affair than after adenoma and requires a much greater degree of post-operative supervision.

In the 36 patients exhibiting hyperthyroidism of adenoma 60 per cent. came to the clinic for cardio-vascular disability rather than for the more obvious goiter. The age incidence varied from thirty-five to sixty years and the characteristic history was that the patient had had a goiter of many years' duration, and aside from the cosmetic effect it had been a matter of no concern to the patient. Loss of weight was not a great factor in the majority of these patients. Their basal metabolism average was +42, and as a group the basal metabolism never reached the elevation present in the hyperthyroidism of Graves' disease. Sixty per cent. of the adenoma group presented definite evidence of organic heart disease, aside from palpitation and tachycardia. It is significant that at the present time this group represents a greater operative risk than Graves' disease. In the series there were three deaths, one following an operation for Graves' disease and two following operation for hyperthyroidism of adenoma. In our opinion, the hyperthyroidism of adenoma is the least influenced by pre-operative medication with iodine. Auricular fibrillation and occasionally, auricular flutter were the chief types of cardiac disability.

It is interesting, however, to note that the recovery, both operatively and

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post-operatively, was more rapid in this group than in Graves' disease and physical and functional competency of the thyroid gland was accomplished by relatively less surgery than in Graves' disease. The cardiac disability was invariably lessened and in many cases functionally cured. It is a noteworthy fact that all five cases of malignancy in this series had their origin in the adenoma group. Three cases were classified as precocious adolescent hyperthyroidism. The youngest patient was thirteen years of age, with a basal metabolism of +77, and the eldest patient sixteen years of age, with a basal metabolism of +68. All three had received rather large quantities of iodine over a long time with no permanent or continuous benefit, but on the contrary after a slight temporary betterment had an increase in their toxicity.

Two of my associates, Doctor Moolten and Doctor Fleming, have independently observed that there are some supposedly colloid goiters in young adults, with normal basal metabolism, which under the administration of Lugol's solution diminish in size, but coincidentally the patient develops a tachycardia and an elevated basal metabolism. We have come to the conclusion that in these patients, while the thyroid gland in general was "toned up" and improved under iodine, there were present in the gland small undetected adenomata which were stimulated and induced some degree of subsequent hyperthyroidism.

Twenty-four patients with colloid goiter were operated upon for pressure symptoms or cosmetic reasons.

We have taken the surgical position that all isolated or discrete tumors, whether single or multiple, occurring in the thyroid gland should be removed. There are four well-defined reasons for this attitude: (1) normal retrogression and disappearance does not take place; (2) there is the tendency to progressive growth; (3) the known tendency for the development of hyperthyroidism, and (4) the actual and potential danger of malignancy.

We have observed a number of cases of typical Graves' disease without any visible or palpable enlargement of the thyroid gland and having a moderate degree of hyperthyroidism. Basal metabolic rates range in the +30 and +40 group. In these cases we have had recourse to X-ray therapy under the direction of Dr. Wm. H. Meyer, and the results have been, on the whole, satisfactory. We have been influenced largely in treating these cases with X-ray upon the following premises: that the size of the thyroid gland renders it extremely difficult to determine how much should be removed by surgical intervention and the greater liability of parathyroid and nerve injuries. On the other hand, the Graves' disease with a definite goiter and a more severe degree of hyperthyroidism is, in our opinion, best treated by surgery as the danger of full, intensive X-ray is greater than the mortality risk in surgery. The final results of full, intensive X-ray therapy is a devitalized, atrophied telangiectatic area that cosmetically is worse in its final appearance than any thyroid incision, and functionally, the final result is more apt to be myxedema than where surgery is employed.

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In regard to basal metabolism, it is essential that the metabolic determinations be made at all times by the same laboratory. After a reasonable experience one is able to estimate, in relative terms, the value of a +20 or a +30; however, only in the early cases do we accept basal metabolism as a controlling guide for surgical intervention. A patient with Graves' disease with a basal metabolism of +60 may be better clinically and surgically a safer risk than another patient with Graves' disease with a basal metabolism of +40. We have found it impossible to correlate the basal metabolic readings for the same patient when obtained from different laboratories.

We have on three occasions observed a temporary rise in basal metabolic determinations after a rather extensive resection of both lobes of the thyroid. There are so many emotional factors that may enter into the basal metabolic determinations that it seems unwise to accept this as the one and only controlling factor in indicating when surgery shall be performed.

In this series only one case had a preliminary ligation, as we have felt that with the pre-operative use of iodine we can obtain as much protection for surgical intervention as we could by ligation.

Of the total number of patients, 74 were clinic and 74 were private. In the hyperthyroidism due to Graves' disease 14 per cent. were males and in the hyperthyroidism of adenoma 20 per cent. were males. Myxedema in mild degree following operation for Graves' disease occurred in three out of 56 patients. In two the basal metabolic readings were -11, and the only symptoms suggesting myxedema were the slight increase in weight and a diminished mental and bodily activity. One of the patients, a male, with a pre-operative basal metabolism of +68, and a previous history of X-ray therapy, plus large doses of Lugol's solution, in seventeen days dropped to -2, and six months later to -26. During this period he gained in weight from 90 pounds to 134 pounds and had a pulse of 90, and at the present time, a little over a year after operation, aside from his minus basal metabolism, gives no evidence of myxedema.

A fourth patient showed severe post-operative myxedema. This patient had two operations for Riedel's struma, subsequent X-ray therapy, and at the present time shows a -41, with well-marked signs of myxedema. The condition is being ameliorated by intravenous injections of thyroxin.

One case of Graves' disease, with a basal metabolism of +42, was four months pregnant and had a bilateral thyroidectomy without interruption of her pregnancy. A secondary operation was performed in three cases of Graves' disease for an incomplete "cure." The first patient had a basal metabolism of +123, which subsequently dropped to +52 after operation and a year later she had a second operation with a drop in basal metabolism to +16. A second case of Graves' disease, with a pre-operative basal metabolism of +64, had a regrowth after operation of the left lobe of the thyroid with a basal metabolism of +28, and eighteen months later was re-operated, with a drop of basal metabolism to normal. This patient subsequently became pregnant and gave birth to a normal child.

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Exophthalmos in some degree has persisted after operation in about 20 per cent. of the cases of Graves' disease.

We had a female patient, aged fifty years, who was admitted to the Medical Ward of the Post-Graduate Hospital, with the diagnosis of adenoma of the thyroid, complicated by vertebral metastasis. Upon admission the patient complained of goiter, numbness of the legs and inability to walk. Upon admission her basal metabolism was +49 and under rest and treatment seventeen days later dropped to +32. The pre-operative diagnosis was multiple nodular adenoma of the thyroid and spinal tumor. A bilateral resection of the thyroid was performed. The pathological diagnosis was "multiple adenoma of the thyroid gland with retrograde changes". Six weeks later a laminectomy was performed by Dr. Byron Stookey for spinal tumor. At operation a round, blood-red protrusion with erosion of the vertebral arch was found beneath the fifth thoracic vertebra. A fairly thorough removal of the tumor was accomplished and the cavity was treated with Zenker's solution. The pathological examination of the spinal tumor showed "metastatic adenoma of the thyroid in vertebra".* This patient was seen ten months later, was perfectly well and had regained the use of her limbs.

The three mortalities in the group occurred in two females with hyperthyroidism of adenoma, and one in a male with Graves' disease. The first death was that of a woman, fifty-four years of age, with a severe hyperthyroidism, chronic myocardial disease and auricular fibrillation, with a basal metabolism of +78. This patient was digitalized previous to operation but died suddenly six hours after operation of embolism.

The second death occurred in a male, thirty-four years of age, with Graves' disease. He had been taking large doses of iodine for the previous six months. Under pre-operative treatment, however, he did not adequately respond to rest, digitalis, iodine or morphine. He was prepared for operation in the general surgical ward which, I think, aggravated his condition. He had a basal metabolism of +95 before operation. Following the operation the patient did surprisingly well for forty-eight hours when he developed marked auricular fibrillation and pneumonia, and died on the third day after operation of cardiac failure and pneumonia.

The third case, a woman, fifty-three years of age, with multiple adenomata and severe hyperthyroidism, basal metabolism of +73 auricular fibrillation and chronic Bright's disease, was operated upon under rectal anaesthesia and the operation was performed without any difficulty. After resection of the right lobe the anaesthetist optimistically reported the patient's condition as excellent, and the second lobe was resected. At the termination of the operation the patient suddenly stopped breathing: artificial respiration was employed, but the patient died in the operating room.

Anaesthesia in Graves' disease has represented our most difficult problem. One of the most disturbing elements in the surgery for Graves' disease is the

* This case was reported by Dr. Locke L. MacKenzie, in the American Journal of Surgery, March, 1929.

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fear and apprehension that is added to the marked nervous disturbance already present. The mere thought of the operation, when it is to be performed, the trip from the ward or room to the operating room, all add a tremendous psychic trauma. To overcome this we have had recourse to rectal anaesthesia in 29 out of 56 cases. This has been most satisfactory, the only objection being the large amount of detail work that is thrown upon the attendants and anaesthetist. Local anaesthesia was not used in any case of Graves' disease. Nitrous oxide was employed once and ethylene-gas anaesthesia in 26 cases.

Recently we have used sodium amytal (Lilly) intravenously which accomplished all that we had sought to arrive at by the more complicated procedure of rectal anaesthesia. Sodium amytal, prepared by Eli Lilly and Company, comes in ampules containing one gram to which is added 10 cubic centimetres of sterile distilled water. After agitating and standing a few minutes a perfectly crystal clear solution should be obtained. Each cubic centimetre of this solution contains 100 milligrams and the injection is made intravenously at the rate of 1 cubic centimetre a minute. The dosage is based upon the range from .020 to .025 per kilo of body weight. We have employed it to produce unconsciousness but not necessarily analgesia. After six to seven minutes the patient is apparently deep in normal slumber and unconscious. The patient is undisturbed for five minutes and then is transported to the operating room. Ethylene anaesthesia is administered and the operation performed. Following the operation the patient has a continuation of an apparently normal slumber and awakens in from two to three hours afterwards. There is no post-operative disturbance and morphine may be used thereafter.

In this series we have had one severe haemorrhage occurring during the course of the operation from a breaking away of the right inferior thyroid artery. While this haemorrhage was not lethal, it was dangerous, and the patient was transfused the next day. We have had no post-operative haemorrhage after the patient left the operating room. We have never packed any of the wounds for haemorrhage. We had one death on the operating table, just at the conclusion of the thyroidectomy—a woman aged fifty-three years, with chronic nephritis, chronic myocarditis, auricular fibrillation, and basal metabolism of +73. The patient had been taking Lugol's solution, fifteen drops twice a day for eighteen months. The condition was estimated as one of extreme danger. Operation under rectal anaesthesia consisted of a bilateral resection. In the light of reflective experience it would have been wiser to have been satisfied with a resection of one side. The patient had tolerated the resection on the right side with such equanimity, and as the anaesthetist reported the patient's condition as good, the operation was prolonged by resection of the left lobe.

We have always believed that any interference with either the superior or inferior laryngeal nerves during a thyroidectomy would produce an immediate change in the breathing and the sudden development of a stridor. We

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have zealously tried in all operative procedures to stop immediately any manoeuvre in which the patient responded with any change in breathing sounds or in the character of breathing. In all of our cases we have made a note of the voice sounds immediately upon the patient regaining consciousness. This was noted in the operating room in cases under gas and some time later in cases under ether. This is important as changes in voice or stridor will occasionally develop from twenty-four hours to three months after a thyroidectomy and occur in cases in which there has been neither anatomical or physiological injury to the laryngeal nerves at the time of operation.

We have had three cases in which voice complications developed. This complication is strongly contrasted in the following two cases:

Mrs. M. was operated under ethylene for a large adenoma. At the conclusion of the operation the breathing was normal, the breath sounds full, deep and ample. Patient was discharged at the end of nine days, and six weeks later reported at the clinic with hoarseness and stridor and some difficulty in breathing. Laryngeal examination showed a paralysis of the left vocal cord. At the end of four months this patient had recovered her voice and the stridor had disappeared, but under any unusual vocal exertion she becomes somewhat hoarse. Mrs. K. was operated upon for multiple adenomata and during the dislocation of a large substernal goiter she developed a slight stridor. Manipulations were stopped immediately and after a momentary rest the approach was made from a different angle. At the conclusion of the operation the patient had a slight hoarseness and in the course of the next seventy-two hours developed considerable stridor, which persisted for about two weeks, never dangerous, nor of sufficient loudness to disturb the adjacent patients. At the end of six weeks she slowly began to improve in voice and lost the stridor. At the present time she has regained about 80 per cent. of her normal vocal capacity. Undoubtedly a physiological injury was inflicted upon the recurrent laryngeal nerve, for a laryngological examination on the fifth day showed a cadaveric left cord.

The development of a severe post-operative tracheitis is an annoying complication and has occurred in a few cases. It is apt to be confused with nerve injury. It occurred in four of our patients who had sustained a rather close dissection of the thyroid from the trachea. In two of them the size of the tumor had caused marked lateral displacement of the trachea. Voice sounds at the termination of the operation and breathing sounds were apparently normal. At the end of twenty-four hours there developed aphonia, marked difficulty in breathing, with stridor, and in two cases it was deemed wise to re-open the wound in the neck, with almost an immediate improvement and subsequent recovery.

In this series tracheotomy was only performed once, in a man that I presented before this Society, and it is the only case that convinced me that such a thing as tracheal collapse could occur.

Most of the complications and difficulties in thyroid surgery are due to the technic employed. In the earlier cases we divided the pre-thyroid muscles on both sides and attempted to mobilize and elevate the gland with the result that we had more trouble from haemorrhage, from temporary breathing difficulties than in the latter part of the series, when we adopted as a uniform

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procedure two definite types of technic. In the retrosternal goiter we first ligate and divide the superior pole. We prefer to ligate the individual vessels rather than use a mass ligature. After division of the superior pole the isthmus is divided in the median line with the result that the goiter is rolled, as it were, from its bed downward and forward over the chest and so out of the superior thoracic aperture. In the other goiters, we have at the beginning, divided the isthmus, then ligated and divided the superior pole and by gentle traction forward and outward have then been able to place hemostats along the lateral surface of the thyroid lobe, thereby clamping the veins that enter and leave the thyroid. In addition, the hemostats laterally give the operator a guide to the point where the resection will terminate so that the posterior capsule, the blood supply to the parathyroids and the nerves are neither exposed, manipulated nor disturbed. This results in the excision of a wedge of thyroid tissue on either side, leaving a thin film of thyroid tissue over the trachea. The result of these procedures has been to simplify the operation, permits early control of the bleeding and insures a much smoother operative technic.

CONCLUSION

Total number of operations	148
Total number of patients	144
Number of re-operated cases	4
Post-operative mortality	3
General anaesthesia	1
Rectal anaesthesia	29
Ethylene anaesthesia	115
Nitrous oxide anaesthesia	3
Basal metabolism	
Highest	+114
Lowest	+3
Average	+45
Hyperthyroidism of adolescence	3
Hyperthyroidism of Graves' disease	56
Hyperthyroidism of adenoma	36
Colloid goiter	24
Non-toxic adenoma	21
Malignant	5
Riedel's struma	2
Tuberculosis	1
Average stay in hospital	10 days
Average pre-operative stay in hospital	4 days
Average post-operative stay in hospital	6 days

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WITH REPORT OF CASE OF CYSTIC LYMPHANGIOMA

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THE purpose of this paper is to report a case of cystic lymphangioma of the mesentery, unusual in size, attachment and character. In making this report I shall briefly review the literature pertaining to this condition and make certain comments based on my personal experience in studying this particular case.

Mesenteric tumors are among the rarest tumors met with in the abdomen. Mesenteric cysts are more common than the solid mesenteric tumors. However, not more than two or three hundred cases of mesenteric cysts have been reported in all medical literature. This paper is confined to the subject of mesenteric cysts. It is not unusual for surgeons of wide experience to conclude their active surgical careers without ever having seen one. It is an interesting fact that in all the medical literature to which I have had access is reported no single instance where the diagnosis of this condition has been definitely and correctly made previous to operation or autopsy.

Nothing really new has been published in the many excellent papers of recent years. From the literature on the subject it appears that the condition was first described by Rokitansky in 1842, although a case had undoubtedly been observed as early as 1507 by Benevieni. It was not until 1897, that Moynihan attempted to give a workable classification of these tumors. However, great scientific interest in mesenteric cysts was first aroused by Dowd, who published an admirable monograph emphasizing the embryonic origin of most of these cysts and reported a relatively large series of cases collected from the literature. He suggested a very simple classification based upon the origin of these cysts as follows: 1, embryonic cysts; 2, hydatid cysts; and 3, cystic malignant disease. Many authors have elaborated on Dowd's classification but perhaps it is only Niosi (1907) who has improved thereon to any extent by his amplification of the classification of mesenteric cysts of embryonic origin as follows: (a) cysts of intestinal origin; (b) dermoid cysts; (c) cysts arising from retroperitoneal organs, *viz.*, urogenital organs.

Ewing, in his book on *Neoplastic Diseases*, for the convenience of pathologists divides these tumors into four main varieties. First, lymphatic or chylous cysts; second, enteric cysts; third, urogenital cysts; and fourth, dermoid and teratoid cysts. He emphasizes the difficulty with which hydatid cysts and cysts of neighboring organs are differentiated clinically from mesenteric cysts. His report of the subject I shall take the liberty of briefly abstracting.

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1. *Chylous cysts* develop either as very large, simple, usually multilocular tumors, or as numerous small swellings of the mesentery, omentum, intestinal wall and retroperitoneal region. The contents are clear fluid or chyle or more inspissated fatty material, and blood is often present. The walls are fibrous tissue in which are many round-cells or lymph follicles, and in the walls are often dilated lymph spaces. The lining is of endothelium and it may be hyperplastic, or it may have undergone degeneration and have disappeared here and there. Klemm and Rittner (Ewing) interpret all mesenteric chylous cysts as cystic lymphangioma and it is in this group that the case hereinafter to be reported is included. That some of these cystic lymphangioma represent merely dilated lymphatics, however, is shown by Kostlivy's (Ewing) study and by the cases of lymph cyst arising after occlusion of local lymphatics in cancer.

2. *Enteric cysts* are intraperitoneal cysts. They form (Ewing) as single or multiple large or small cysts, along the lower end of the ileum in the wall of the intestine, or at the point of Meckel's diverticulum (Roth), or in the mesentery, or near the navel (Wyss). When originating within the muscular wall of the intestine they usually remain connected with this organ and are enclosed by a muscular wall. The cyst wall resembles that of the intestine and has a lining of epithelium.

3. *Urogenital cysts*.—Intraperitoneal cysts of nephrogenic origin are rare (Ewing). Niosi collected five cases. These cysts, of large size, single or multilocular, involve the mesentery and adjacent regions, or extend into the pelvis. They occur chiefly in adult women. The contents are brownish, serous fluid, containing pseudomucin. The wall is composed of fibrous tissue and the lining is of high cylindrical or cuboidal glandular epithelium. The origin of these cysts is not definitely known.

4. *Dermoid and teratoid cysts* of the mesentery and peritoneum are rare (Niosi). They are located in any portion of the mesentery from coeliac axis to pelvis, and their dimensions may be considerable. Peritoneal teratoid cysts are even more rare than dermoid cysts.

Occurrence.—Mesenteric cysts occur most commonly in the third decade of life, although case reports of this condition in infants four months of age and in octogenarians are on record. These cysts develop more often in women than in men, and occur to the right of the median line and below the navel in a very large majority of cases. Trauma is given as an important etiological factor in many case reports.

Complications.—Swartley, of Philadelphia, in May, 1927, in an excellent paper brought the bibliography and such new thoughts on the subject as have developed in recent years, up-to-date. He mentions intestinal obstruction as the most frequent and the most serious complication of this disease. In various collected reports the incidence of intestinal obstruction appears to be approximately 50 per cent., and the mortality from this complication ranges from 35 to 50 per cent. Swartley is of the opinion that obstruction is due to mechanical causes, such as, narrowing of the lumen of the bowel from the immense size of the tumor, volvulus, intussusception, kinking, and adhesions from pressure of the tumor. He notes as other complications the following: peritonitis, which is usually a sequel of obstruction; haemorrhage into the cyst; rupture of the cyst; and torsion.

Symptoms and diagnosis.—There are no characteristic symptoms or signs of mesenteric cyst, and this has made the differential diagnosis, even where such cyst is suspected, very difficult. In consequence, as heretofore stated, no case of mesenteric cyst has been reported as correctly diagnosed previous

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to operation or autopsy. However, one should at least suspect mesenteric cyst if there be observed an abdominal tumor, smooth, rounded, apparently cystic and freely movable, in an otherwise healthy individual, particularly a female, who has undergone recurrent attacks of abdominal pain later associated with nausea and perhaps vomiting, and the examination has established that the pelvic organs are not affected. These patients may have severe constipation or they may have diarrhoea alternating with constipation. Evidently there is sufficient embarrassment of the bowel to produce obstruction of the lumen and therefore increased peristaltic activity above the attachment of the tumor. None of these patients waste as do patients suffering from malignant tumors; in fact, many of them gain in weight. Occasionally the presence of a palpable tumor in the abdomen, even though the patient has no symptoms of any sort, brings the patient thus afflicted to the surgeon. If for any reason the tumor has become inflamed when the case is first observed, extreme care must be given to differential diagnosis so as to distinguish such tumor from the usual acute abdominal conditions, such as acute appendicitis, acute intestinal obstruction, ovarian cyst with a twisted pedicle, retroperitoneal growth, movable kidney, pancreatic cyst and new growth of the intestine with secondary infection. Strangely enough instances are reported wherein the presence of such cysts has been mistaken for pregnancy.

I am of the opinion that the case reported has rather a typical history, which is as follows:

CASE REPORT.—D. W., white girl, sixteen years of age, was admitted to Baylor Hospital the night of November 10, 1928. She was acutely ill; temperature 102°; pulse 140; respiration 24. She complained of first, pain in abdomen; second, nausea; third, no evacuation of bowels for three days; fourth, abdominal distention, tenderness and rigidity; fifth, general malaise.

Past medical history.—About six years ago, she received a severe blow in the upper left abdominal quadrant which caused her great pain and suffering for about four days. She has felt, since that time, that there was something wrong in that portion of her abdomen. She has always been a very active, healthy child, doing more than her share in work and play. Following recurrent attacks of tonsillitis, her tonsils were removed several years ago. About one year ago, her mother first noticed that her abdomen was enlarging, and she was gaining weight though exercising vigorously. It was at this time that she began to feel a definite sense of fatigue following even moderate exercise. She has suffered from constipation since infancy.

Menstrual history.—Menses began at fourteen years of age, always very irregular, periods coming at intervals of three and four months; the flow always profuse, lasting four to ten days. No cramping or other discomfort associated with menstrual period.

Family history.—Mother, father, two brothers and one sister living and well.

History of present illness.—Patient for several weeks has had attacks of cramping pain associated with nausea, the pain being severe and present particularly in the iliac fossæ. She has felt tired and when walking she has been conscious of a heavy weighty feeling in her abdomen pulling her forward. She has never vomited, and the cramping ordinarily lasted about four days. Her abdominal muscles are rigid and she has difficulty in straightening up. The most severe attack, previous to the present one, was four weeks ago. Her bowels move only after purgation. In the interval between the attack four weeks ago and the attack which came on forty-eight hours ago, she has felt fairly well, except that she has felt lazy and disinterested in things which ordinarily would

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interest her. She has played tennis, danced, and has not missed a period in the gymnasium during the school year. Forty-eight hours ago, she finished her gymnasium work and decided to walk. This she did, walking about four miles, and returned home exhausted, nauseated, and with a severe pain in her abdomen. The pain and soreness has continued for two days, associated with nausea, abdominal-muscular rigidity, and severe constipation. The pain in her abdomen is aggravated by lying on her back.

Physical examination.—She lies quietly in bed, not complaining except when disturbed. The examination of the head, neck and chest is entirely negative. The abdomen is rigid and distended. Liver dulness and splenic dulness are continuous with dulness in the abdomen. It is impossible to palpate the margin of the liver or the spleen. Even though there is marked distention and rigidity it is possible to introduce the examining fingers rather deeply into the abdomen just above the brim of the pelvis. Palpation of the abdomen reveals marked resistance over the whole anterior abdominal wall, more like an inflammatory process than a tumor. However, that exquisite tenderness to sharp palpation characteristic of acute inflammation is absent. Bimanual examination of the pelvis is negative; the uterus is small and the adnexæ seem normal. Blood analysis shows a leucocyte count of 16,000; polymorphonuclear leucocytes 83 per cent.; small lymphocytes 11 per cent.; large lymphocytes 5 per cent.; transitional 1 per cent. Urinalysis: specific gravity 1.015; negative for sugar, albumen and pus. Blood Wassermann, made the following day, is negative.

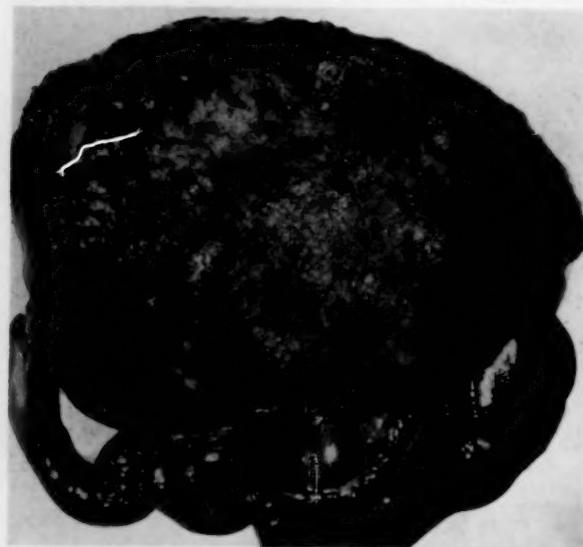


FIG. 1.—Photograph of tumor measuring 9½ inches by 8 inches by 4 inches. Note cystic areas on surface, together with small grayish elevations, some old blood and fibrinous exudate on surface.

nite information might be obtained in this way. After two days' acute illness with appendicitis and peritonitis, or peritonitis from some other cause, one should expect to find a patient obviously very sick with nausea and vomiting, apprehensive, and with other evidences of a severe toxæmia. Almost the opposite of this picture was found in this case. I was unable to outline a tumor, although the resistance to palpation suggested such a condition. I felt sure that there was not a localized abscess in the right lower quadrant. I palpated the uterus and adnexæ and thereby ruled out a pelvic tumor. I could not make a definite diagnosis, but felt that the patient had some acute inflammatory condition in her abdomen producing obstruction of the bowel, and advised an immediate abdominal exploration.

Operation.—Under ether anaesthesia a right rectus incision, four inches long, was made. When the peritoneum was opened a large amount of very dark blood, under pressure, was released. A rapid exploration was made and I determined that I was dealing with a tumor, originating in the left upper quadrant and extending obliquely across the abdomen into the right iliac fossa. The tumor (Fig. 1) practically filled the abdomen. The incision was lengthened above and below until I was able to deliver the tumor. This required an incision the full length of the rectus muscle, and this

Diagnosis.—I regret that a pneumoperitoneum could not be done, as I believe that in less acute situations very defi-

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incision gave excellent exposure. I found that the pedicle of the tumor was about four inches across, and was attached to the mesentery of the first portion of the jejunum immediately distal to the ligament of Treitz. The blood supply to that portion of the jejunum passed directly through the tumor attachment; the base of the pedicle extended to the posterior body wall; however, the base of the pedicle did not include the bowel wall. The problem with which I was face to face was obviously difficult. I first attempted to dissect the pedicle free of the mesentery and found that this was impossible without injury to the circulation of the bowel. I then decided that a resection of a considerable portion of the jejunum together with the tumor was the only solution. There were no enlarged lymph glands in other portions of the mesentery or the great omentum. The bowel was clamped just below the ligament of Treitz and also beyond the tumor, and the intervening portion was resected together with the pedicle of the tumor. A complete operation removing all affected tissue together with forty inches of bowel was accomplished. The bowel was reunited by end-to-end anastomosis and the abdomen closed without drainage. In the post-operative treatment glucose intravenously and normal saline solution subcutaneously were given at intervals for three days, and



FIG. 2.—Drawing of mesenteric tumor $9\frac{1}{2}$ by 8 by 4 inches, together with resected bowel. Note irregular surface varying from small cysts to dense fibrous tissue.

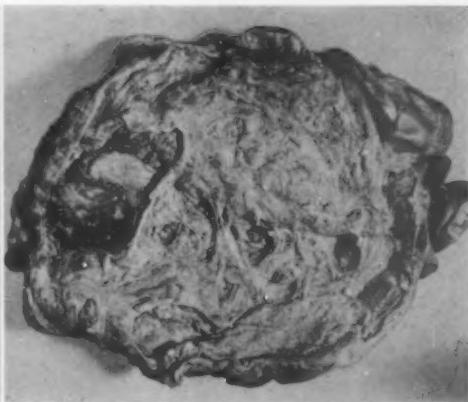


FIG. 3.—Photograph of bisected tumor showing cystic areas and dense fibrous tissue stroma.

in consequence there was neither a decrease in chlorides nor the development of an acidosis. The patient made an uneventful recovery and was up in a wheel chair on the fourteenth day. Two days later, November 27, 1928, she was discharged from the hospital and resumed her school work four weeks after the operation. She has been examined recently and it has been determined that the wound has healed, that she has gained several pounds in weight, and that apparently she is in perfect health.

Gross description of tumor.—The tumor was firm with irregular surface and margins and measured $9\frac{1}{2}$ by 8 by 4 inches. Its color was dark blue and there was considerable oozing from its surface. Many small, soft areas on the surface resembled dilated veins, and were easily ruptured and contained a dark, viscid material. The bowel attached to the tumor measured 40 inches.

Tissue report by Dr. M. T. Richardson. *Gross appearance.*—Specimen consists of tumor measuring 20 by 12 by 12 centimetres (specimen has been in ice box for forty-eight hours). Is dark red in places, gray in others, irregular in outline, apparently cystic on outer surface, shows presence of numerous small gray elevations (Figs. 2 and 3). There is attached about 74 centimetres of small intestine. This is attached to tumor by mesentery. There are no enlarged mesentery glands. On section, tumor cuts with little resistance and seems to be composed of numerous cystic spaces containing salmon-colored turbid fluid, some blood clots, and friable material suggesting fibrin. In

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general the tumor is trabeculated in appearance. Cystic spaces have smooth lining, best seen following removal of fibrin-like material. Color varies from gray to pink and dark red. (Figs. 4 and 5.)

Microscopical findings.—Section of tumor shows numerous channels of varying size, some of which are collapsed and only in small parts containing blood-vessels. Between these there is considerable oedematous connective tissue, in which is an infiltration of lymphocytes. Also, in areas in stroma there are large cells, apparently endothelial, whose cytoplasm contains numerous vacuoles of varying size together with slight amount of finely granular brown pigments. Channels are for the most part lined by flattened endothelium.

Pathological diagnosis.—Lymphangioma.

Treatment.—The treatment of mesenteric cysts is always surgical and the condition usually requires an emergency operation. Five methods have been

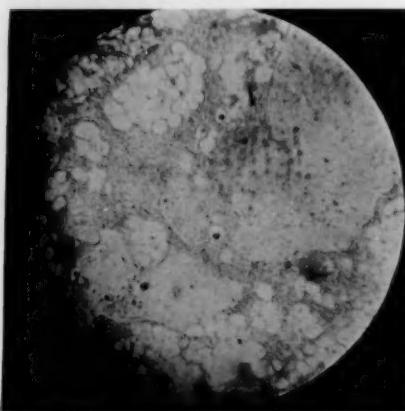


FIG. 4.—Microphotograph (low power) showing cystic areas in channels of varying size. Between these there is oedematous connective tissue, in which is an infiltration of lymphocytes.

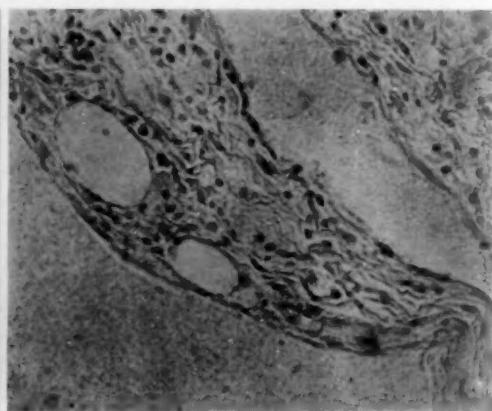


FIG. 5.—Microphotograph (high power) of tumor showing large endothelial cells in stroma. Channels lined by flattened endothelium. Also shows type of material in cysts.

used in the treatment of mesenteric cysts. 1, aspiration; 2, marsupialization; 3, drainage; 4, enucleation; 5, resection.

1. Aspiration is a method which should never be used, as it has been demonstrated to be wholly unsatisfactory.

2. Marsupialization is only applicable in cases of hydatid cysts or of very large unilocular cysts where removal of the tumor is extremely hazardous.

3. Drainage in selected cases may suffice and the mortality is only about 6 per cent. Unfortunately a persisting sinus often calls for resection later.

4. Enucleation is the best method provided its use is feasible. The mortality is about 16 per cent. Where the tumor can be completely removed this method gives excellent results.

5. Resection is the method indicated in most instances, especially if the tumor is so large or is so attached that the circulation of the bowel is interfered with in an attempt to remove the tumor by other methods. The mortality is about 60 per cent. This high operative mortality is in part explained by the fact that in many cases requiring resection, the patient has

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already developed intestinal obstruction of some degree, and frequently has a local peritonitis.

Prognosis.—Although mesenteric cysts are benign tumors, the prognosis depends on the size, location and site of attachment of the tumor, and to a still greater extent on the time at which the diagnosis is made and operation carried out. The outcome is also largely dependent upon whether the tumor can be removed by one of the less serious surgical procedures such as enucleation, or by one of the more serious operations such as resection. The presence of intestinal obstruction or peritonitis, so frequently observed in cases operated as an emergency, makes the primary mortality very high.

Summary.—The case reported is of interest because of the rarity of mesenteric cysts. The symptoms were rather typical. A positive diagnosis was not made. The tumor was an unusually large one and bore out Keen's suggestion that the size of the tumor and the pressure resulting therefrom, usually explain the symptoms. The tumor was firm, but contained many small cysts lined with endothelium and turbid fluid. Some of these cysts were collapsed and others contained connective tissue. The tumor is a lymphangioma, cystic in type, but apparently a firmer tumor than most authors have hitherto described. The repeated attacks of cramp colic and the marked constipation heralded an oncoming intestinal obstruction. There were no glands enlarged in the mesentery, therefore it is reasonable to believe that there was no tuberculous phase to the condition. It is also interesting to note that this tumor developed from the first portion of the mesentery of the jejunum. Resection of a large section of the jejunum together with the tumor seemed necessary and was carried out with success, as is evidenced by the patient enjoying perfect health thirteen months after operation.

CONCLUSIONS

1. Since the reported case came under my observation, I have become convinced that the condition is more common than is generally thought. I am sure that many mesenteric cysts have been observed or removed and the character of the tumor not suspected. I have knowledge of a number of tumors removed or observed by my colleagues which I am inclined to believe were mesenteric cysts.

2. The high mortality in the treatment of this condition is due to the late recognition of the disease, usually during an emergency operation, at which time the serious complications of intestinal obstruction and peritonitis have already developed. Under such circumstances, resection of the bowel naturally carries with it a very high primary mortality.

3. These tumors are sufficiently common to justify consideration of the condition whenever an abdominal tumor is observed. The symptoms and signs are not characteristic and the diagnosis must be made by the exclusion of the more common tumors met with in the abdomen.

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BIBLIOGRAPHY

- ¹ Alton, B. H.: Lipoma of Mesentery. *Boston M. and S. J.*, vol. clxxxv, pp. 205-207.
- ² Ayer, James C.: Enteric and Mesenteric Cysts, *Amer. J. Med. Sci.*, vol. cxxxii, pp. 89-108.
- ³ Baumann, E. P.: Mesenteric Cysts. *Lancet*, vol. i, pp. 1272-1273, 1904.
- ⁴ Baldwin, J. F.: Huge Fibroma of the Mesentery: Resection of six feet of Jejunum: Recovery. *Am. J. Surg.*, vol. ii, pp. 160-161.
- ⁵ Bartlett, E. I.: Mesentery Cysts. *S. Clin. N. America*, vol. iii, pp. 811-821, June, 1923.
- ⁶ Bay and Wilkison: Consideration of Mesenteric Cysts with Report of Case. *Am. J. Surg.*, vol. xxxvii, pp. 309-311.
- ⁷ Benedict: Bibliography of Chylous Cysts of the Mesentery. *Surg., Gynec. and Obst.*, vol. xvi, pp. 606-610.
- ⁸ Bigelow, Scott and Obenour: Lymphosarcoma of the Mesentery. *ANNALS OF SURGERY*, vol. lxxxvii, pp. 879-882.
- ⁹ Bogart: Case of Multiple Cysts of the Mesentery. *J. A. M. A.*, vol. lii, pp. 637.
- ¹⁰ Carter: Cysts of the Mesentery. *Surg., Gynec. and Obst.*, vol. xxxiii, pp. 544-547.
- ¹¹ Child, Strong and Schwartz: Mesenteric Cysts—Clinical Reports. *Am. J. Obst.*, vol. lxviii, pp. 491-499.
- ¹² Clark: Case of Mesenteric Cyst. *Am. J. Obst.*, vol. xi, pp. 238-243.
- ¹³ Coley: Mesenteric Cyst in a Child. *ANNALS OF SURGERY*, vol. li, p. 572.
- ¹⁴ Coley: Primary Neoplasms of the Lymphatic Glands including Hodgkin's Disease. *ANNALS OF SURGERY*, vol. lxiii, pp. 35-70.
- ¹⁵ Cumston: Symptomatology and Diagnosis of Cystic Neoplasms of Ascending Mesocolon. *Internat. Clinics*, vol. ii, pp. 155-162, June, 1925.
- ¹⁶ Cutler and Merriam: Intestinal Obstruction in Infant Due to Mesenteric Cyst with Volvulus. *Boston, M. and S. J.*, vol. cxc, pp. 550-552.
- ¹⁷ Dannreuther: Lipomatosis and Megacolon Tumors with Muscular Atrophy of the Abdominal Wall. *Am. J. Obst. and Gynec.*, vol. xvi, pp. 267-269.
- ¹⁸ Darnall: Fibromata of the Mesentery: Case. *ANNALS OF SURGERY*, vol. lxxxvii, pp. 870-871.
- ¹⁹ Deaver, H. C.: Congenital Mesenteric Cyst. *ANNALS OF SURGERY*, vol. xliv, pp. 618-627, 1909.
- ²⁰ DeCourcy and Maloney: Fibromata of Mesentery with Report of Case. *Surg., Gynec. and Obst.*, vol. xl, pp. 402-403.
- ²¹ Dowd: Mesenteric Cysts. *ANNALS OF SURGERY*, vol. xxxii, pp. 515-542.
- ²² Ewing: Neoplastic Disease. Third edition, Saunders, 1928.
- ²³ Frazier: Mesenteric Cysts. *J. A. M. A.*, vol. lxi, pp. 97-99.
- ²⁴ Friend: Mesenteric Chyle Cysts. *Surg., Gynec. and Obst.*, vol. xv, pp. 1-6.
- ²⁵ Gould: Three Mesenteric Tumors. *British J. Surg.*, vol. iii, pp. 42-47.
- ²⁶ Green: Enteromesenteric Cysts. *Surg., Gynec. and Obst.*, vol. xliv, pp. 401-404.
- ²⁷ Haworth: Case of Mesenteric Tumor. *Lancet*, vol. i, p. 1269, 1920.
- ²⁸ Higgins and Lloyd: Mesenteric Cysts: with Report of Two Cases. *Brit. J. Surg.*, vol. xii, pp. 95-105.
- ²⁹ Hueper: Mesenteric Enterocystoma. *J. Lab. and Clin. Med.*, vol. xii, pp. 427-430.
- ³⁰ Hunter: Mesenteric Cyst of Jejunal Origin Complicated by Retrojejunal Position of Transverse Colon. *Brit. M. J.*, vol. ii, pp. 800-802, 1922.
- ³¹ Jones: Cysts of the Mesentery. *Surg., Gyn. and Obst.*, vol. xxi, pp. 56-60.
- ³² Kyle: Fibroma of the Mesentery. *Brit. J. Surg.*, vol. ix, pp. 295-296.
- ³³ Ladd: Two Cases of Omental Cyst and One Mesenteric Cyst. *Am. J. Dis. Chil.*, vol. xxxii, pp. 701-705.
- ³⁴ Lang: Two Cases Showing Unusual Surgical Affections of the Mesentery. *Canad. M. A. J.*, vol. xviii, pp. 573-576.
- ³⁵ Lapage and Morley: Large Mesenteric Cyst in Infant: Removal: Recovery. *Lancet*, vol. ii, p. 1116, 1925.

MESENTERIC CYSTS

- ³³ Makins: Retroperitoneal and Mesenteric Cysts of a Simple Nature. *ANNALS OF SURGERY*, vol. liii, pp. 355-363.
- ³⁴ Miller: Mesenteric Cysts. *Johns Hopkins Hospital Bulletin*, vol. xxiv, pp. 316-322.
- ³⁵ Moynihan, B. G. A.: *ANNALS OF SURGERY*, Phila., vol. xxvi, p. 1.
- ³⁶ Niosi, Francisco: *Arch. of Path. Anat. etc. Berl.*, (quoted by Ewing, Carter, Miller and others).
- ³⁷ Oliver: Mesenteric Cyst in Young Married Woman. *Brit. M. J.*, vol. ii, p. 289, 1917.
- ³⁸ Outland and Clendenning: Enormous Abdominal Cyst, Probably Due to a Retained Testis. *Surg., Gyn. and Obst.*, vol. xxii, pp. 204-205, 1916.
- ³⁹ Parker: Mesenteric Cysts; Report of Three Unusual Abdominal Cases. *Am. J. Roentgenol.*, vol. x, pp. 605-610.
- ⁴⁰ Porter: Chylous Cysts of the Mesentery, *ANNALS OF SURGERY*, vol. xliii, pp. 380-389.
- ⁴¹ Ransohoff and Friedlander: Solid Tumors of the Mesentery. *ANNALS OF SURGERY*, vol. Ixxiii, pp. 211-214.
- ⁴² Royster: Chylangioma in a Child: Case. *Am. J. Dis. Child.*, vol. xxxv, pp. 637-640.
- ⁴³ Ryan: Cysts of the Omentum. *ANNALS OF SURGERY*, vol. Ixxxiv, pp. 567-680.
- ⁴⁴ Shallow: Entero-mesenteric Cysts. *ANNALS OF SURGERY*, vol. Ixxxii, pp. 795-800.
- ⁴⁵ Shands: Chylous Cysts of the Mesentery, Case Report. *South. Med. J.*, vol. x, pp. 484-486.
- ⁴⁶ Strong and Swartz: Mesenteric Cysts, Pathological Reports. *Am. J. Obst.*, vol. Ixviii, pp. 491-499.
- ⁴⁷ Swartley: Cysts of the Mesentery. *ANNALS OF SURGERY*, vol. Ixxxv, pp. 886-896.
- ⁴⁸ Wade and Steigrod: Cysts of the Mesentery, Case Report. *Med. J. Australia*, vol. i, p. 465, 1928.
- ⁴⁹ White: Mesenteric or Enterogenous Cyst. *J. A. M. A.*, vol. Ixxiv, pp. 440-442.

EFFICIENCY OF THE VARIOUS TYPES OF ANASTOMOSES OF THE HOLLOW VISCERA

CLINICAL AND EXPERIMENTAL DATA

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I. EXPERIMENTAL WORK.—The efficiency of an anastomosis in experimental work on dogs can only be tested by the effect it has on the animal's nutrition. Obviously, in dogs we cannot observe the results of an anastomosis performed for diseases of the gastrointestinal tract similar to those which occur in man. In the lower animals we have depended on two factors to tell us whether an anastomosis was efficient: first, the X-ray; and second, the state of the function of nutrition of the animal.

Every type of gastrointestinal anastomosis was performed in our experiments. They included a Billroth No. 1 and No. 2, posterior gastroenterostomy, a Finney and Horsley, and the massive resection of the stomach followed by the Polya type of anastomosis or a posterior gastroenterostomy. While we performed the Finney and Horsley operations on the dog, their field of usefulness as applied to man is quite limited. In all instances X-rays were taken before and after operation. Unfortunately, when we performed a Billroth No. 2 or a resection of the stomach, enough time was not at our command to make an X-ray study of the operative field because in almost every instance the dog succumbed.

Physiological differences were noted when we performed a Billroth No. 1 and No. 2. Death was not due to any error in technic, resulting in peritonitis, intestinal obstruction or haemorrhage following a Billroth No. 2 operation. Nothing gross could be detected to account for the death of the dog within five or six days following the operation. These operations were performed by means of a simple severance of the duodenum distal to the pylorus or a piece of duodenum was excised. In any event, both ends were closed and a posterior gastroenterostomy was performed. While explaining our experience to Bassler, he confirmed our observations, though he could not give us any adequate explanation for the death of these animals. Recently we repeated our experiments again to prove our contention that animals operated upon by the Billroth No. 2 method died. The result was the same.

Much has been written recently on a deficiency of chlorides which probably is an effort on the part of the body to maintain a normal acid-base equilibrium. We examined the blood of the dog for the estimation of the chlorides. While they were lower than before operation, there was not enough reduction to cause the death of the animal. Again, in our operation on the dog we did not interfere with the normal peristalsis. About six inches

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away from the closure of the duodenum we attached the stomach to it which left a proximal pouch of the duodenum.

If the dog survived the operation it made practically no difference at all as to the type of operation which was performed. A few days after operation their appetites returned and they regained their former weight in a comparatively short time. The anastomoses were all efficient and one had no choice as to the so-called best operation from which to choose.

An X-ray of the normal stomach of the dog can well be compared to those taken in man. The anatomical relations are much the same, notwithstanding the fact that the animal walks on all fours. The stomach in the dog lies transversely to the long axis of the body. The pylorus is well defined and the duodenum follows on as in man, with the pancreas in the same anatomical relations as well. While in some of the X-rays the normal stomach is much shaped like a ball, in actual life this is not the case.

As stated before, little opportunity is given the observer to study the results of anastomoses in the dog where there has been an excision of part of the stomach followed by a posterior gastroenterostomy. We have observed, however, that if we perform a Billroth No. 2 sometime after a Billroth No. 1, a tolerance has been created in the animal after which he is more likely to survive a resection of the stomach.

2. CLINICAL WORK.—It is difficult to make comparisons of the efficiency of the various gastrointestinal anastomoses between those performed on man and animals because the reasons for doing these operations are so dissimilar. Only the physical results can be compared. In man an anastomosis is performed for some serious diseased condition of the hollow viscera. In fact, no one at present would do a gastroenterostomy, for instance, on the possible existence of an ulcer. There must be a demonstrable lesion before the patient is subjected to such a serious operation. In the dog, however, we are not confronted by diseased conditions; we are only interested in the results obtained from a study of the mechanical efficiency of the anastomosis.

Our primary object of pursuing this study was an attempt to help clear the horizon, if this be possible, of the still unsettled question as to the kind of operation to be performed in certain diseased states of the hollow viscera, with special reference to ulcer of the stomach and duodenum. In the minds of some surgeons there is a fixed idea as to the type of operation that should be performed in patients having a chronic gastric duodenal ulcer. To me it seems unwise to have any preconceived idea as to the kind of operation to be performed before the abdomen is opened and the lesions inspected and palpated. By means of palpation and inspection alone is it possible to determine the character of operation to be performed in the best interest of the patient.

The dogmatic statement and practice that a gastric resection should be performed on every patient suffering from a chronic gastric and duodenal ulcer is, to say the least, poor judgment. I advocate and perform the massive resection of the stomach in selected cases. I have had occasion to employ

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this operation for duodenal and pyloric ulcers. I would not advise its universal application in all cases. In support of this operation I must say that the convalescence in the successful cases is all that can be desired, while the ultimate results are very good. Symptomatically, these patients who have had the massive resection performed are free from some of the disturbances following posterior gastroenterostomy. I do not deny that there is a large field of usefulness for the latter operation. The success or failure of a gastroenterostomy depends in part on the location and size of the stoma. Whenever we are able to select a site for the anastomosis it should be placed not directly under the cardiac end of the stomach nor should there be any tension on the proximal duodeno-jejunal junction. Occasions arise when the selective point for the anastomosis cannot be chosen, especially where a previous operation has been performed, or where the stomach has been cicatrized and distorted due to ulcers on its borders and walls.

The efficiency of an anastomosis also depends on the size of the stoma. Our object should always be to have a stoma large enough to admit the index finger and the thumb, so that they can readily meet, the walls of the anastomosis naturally intervening. If the stoma is placed under the cardiac end of the stomach, the food has a tendency to drop into the jejunum. This, in turn, may cause diarrhea immediately after eating.

With the working efficiency of an anastomosis are naturally linked morbidity and mortality. When we speak of morbidity, we have in mind unpleasant symptoms that arise after an anastomosis has been performed, or the sequence of an ulcer occurring at the site of anastomosis. On comparing the various anastomoses, it is often stated that ulcers occur most frequently after a posterior gastroenterostomy than after massive resection of the stomach. As a matter of fact jejunal ulcers occur after both types of operations, but their frequency is so negligible as not to influence us in the selection of one kind of operation over another.

Naturally, the mortality after a posterior gastroenterostomy should be lower than after a gastrectomy, provided the latter is well planned and executed.

We have selected a few cases to demonstrate that all the various anastomoses we perform are efficient from the mechanical standpoint, provided we place the stoma in the proper position and without a loop formed by the attachment of the jejunum to the stomach. In favorable post-operative symptomless patients their health does not depend on the fact that they have had a posterior gastroenterostomy or a resection of the stomach or a resection followed by the Polya technic. To this class without symptoms belongs the great majority of patients operated upon.

After these generalizations on anastomoses, let us turn to the specific cases under consideration. Each was operated upon in the Jewish Hospital.

CASE I.—A woman, M. C., aged thirty-five years, was admitted April 19, 1920. She complained of pain intermittent in character. The pain began in the epigastric region and radiated to the back. Forced vomiting relieved pain. Operation revealed an ulcer

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on the posterior wall of the stomach adherent to the pancreas. We opened the stomach, sewed the mucous membrane over the ulcer and performed a posterior gastroenterostomy. Five years later she again developed symptoms. The ulcer was then excised without disturbing the anastomosis. Some of the opaque meal passed through the anastomosis, but "during this time more of the meal is seen to escape from the stomach through the pylorus." Since the last operation the patient has enjoyed good health.

CASE II.—A male, C. H., aged forty-eight years, admitted December 9, 1921, for haematemesis. Indigestion for some time. Radiographs showed an ulcer on the lesser curvature at the pylorus. The pylorus was excised and a Billroth No. 2 operation was performed. A recent X-ray shows "the stomach lying high in the abdomen. No retention of the meal was seen after a six-hour period. Pyloric cap is absent. The barium meal flows freely through an opening in the posterior portion of the stomach." He has never had a symptom since his discharge from the hospital.

CASE III.—A rather remarkable case, that of a man, M. H. S., seventy-three years old. Admitted February 26, 1923. He complained of gastric disturbances. In addition, he was jaundiced. Abdominal examination revealed a mass in the epigastric region. When the abdomen was opened we found a rather large tumor of the stomach with a secondary growth in the pancreas, obstructing the common bile duct. A diagnosis of carcinoma of the stomach and pancreas was made. Resection was out of the question. We contented ourselves with a posterior gastroenterostomy and an anastomosis of the gall-bladder to the stomach. The operation relieved him of all his symptoms. He is well today, five years after the operation. An X-ray study now shows "the stomach lying high in the abdomen. A very small quantity of the opaque meal passes through the pyloric cap. Most of it passes through an opening in the posterior wall of the stomach. No retention is seen after the usual emptying time. Nothing abnormal is noticed at the gastroenterostomy opening."

The simplest form of operation for the relief of symptoms is a posterior gastroenterostomy. We are often compelled to do this operation on account of the poor physical condition of the patient. This circumstance may be caused by haemorrhage and a fear to eat, causing great emaciation and anaemia. This is the type of case in which, after opening the abdomen, it is difficult to differentiate between a chronic gastric ulcer and carcinoma. The following illustrates this type.

CASE IV.—A man, T. I. W., aged fifty-one years, admitted February 10, 1926, told us he was perfectly well up to three months ago, when he began to have pain after eating. He vomited once a day, the vomitus being coffee-ground material. He was extremely emaciated. A diagnosis of pyloric carcinoma was made. A posterior gastroenterostomy was the sole operation performed. The growth at the pylorus was not removed on account of the precarious condition of the patient. The liver showed a few nodules resembling metastasis. Microscopically, these were benign. This man comes to our follow-up clinic looking well and symptomless. He refused to come for a recent X-ray.

A series of massive resections of the stomach followed by posterior gastroenterostomies or the Polya operation are next to be considered. A gastrectomy or the so-called Finsterer operation was performed in some cases for duodenal ulcer. Here is probably the greatest cause for controversy between those who advocate simple posterior gastroenterostomy with the excision of the ulcer and those who prefer the massive resection of the stomach, reference to which mention has already been made above.

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Suffice it to say that I have been much gratified with the immediate convalescence and the ultimate cure of the patients on whom I have performed the Finsterer operation.

CASE V.—A woman, S. G., aged forty-two years, admitted December 5, 1924. She complained of pain in the epigastrum. She was perfectly well up to July, 1924, when she had an attack of severe pain in the mid-epigastrum. Pain was relieved after eating. At operation a portion of the duodenum, including the ulcer and a large portion of the stomach, was removed. The radiograph shows that the "stomach is empty after the ingestion of an opaque meal." On account of the rapid progress of the barium column there is intestinal hypermobility.

The next two cases illustrate different types of operation for gastric ulcer. In one, we resected a large portion of the stomach and performed a posterior gastroenterostomy. In the other, the Polya operation served a better purpose, because very little of the stomach remained after operation.

CASE VI.—A male, H. A. M., aged forty-nine years, was admitted April 15, 1925. He complained of pain after eating. The pain began two or three hours after meals. He forced himself to vomit, after which he felt relieved. He lost twenty pounds in two months. In this patient the stomach was resected and the gastric and the duodenal ends were closed. A posterior gastroenterostomy completed the technic. The radiologist reports that "five hours after the ingestion of an opaque meal at least one quarter of it was still in the stomach. There is apparently a gastroenterostomy opening through which practically all of the opaque meal leaving the stomach goes."

In the next patient with ulcer of the stomach, we performed a Polya operation after resection of the stomach.

CASE VII.—A male, S. R., aged fifty-nine years, admitted April 6, 1926. He complained of vomiting which began ten years ago. It recurred four years later, then subsided, and reappeared three years ago. The patient was free of symptoms until three weeks previous to operation when the vomiting occurred again, coming on one and a half hours after meals. He was quite emaciated. When the abdomen was opened there seemed to be a possible malignancy. A large resection was performed, a loop of jejunum was brought up through the transverse mesocolon to the cut end of the stomach. Today, the radiologic report reads, "No retention of the opaque meal is seen after the usual emptying time. Within a half an hour the stomach is completely empty. The pyloric cap cannot be outlined."

The last illustrative case in this group of gastric resections is remarkable because of the extensive carcinoma that existed in the stomach and also because of the complete ultimate recovery of the patient.

CASE VIII.—E. S., a man aged seventy-one years, admitted March 5, 1926. He complained of pain in the upper right abdomen. He had vomited for three weeks. After this the pain became quite severe, necessitating his removal to the hospital. At operation a large mass obstructing the pylorus was found. A massive resection was followed by a Polya operation. The patient developed complete retention of urine for which a suprapubic cystotomy was done. The prostate was not removed as he regained the normal urinary function. The pathologist reported mucoid carcinoma of the pylorus. The radiologist says that, "six hours after the ingestion of an opaque meal, the stomach still contains half of it. Eight ounces of the opaque solution were administered and what is apparently the stomach was fully distended. The opaque meal escapes from the

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stomach through a narrow orifice at its superior and right corner. Peristaltic waves were quite vigorous, but rather ineffectual." This patient returned to work again as a machinist.

All the patients reported are living in a fine degree of comfort, symptomless and possessing an efficient anastomosis.

Finally, it has been our experience that it makes very little difference concerning the kind of anastomosis made, so long as the stoma is properly placed and of the right size. Again the anastomoses in the main have been lateral or end-to-side, depending on the nature of the lesion for which the anastomosis was made. We have made practically no use of the Finney or Horsley operations, although in our experimental work we performed these operations and found them efficient. Physiologically, the end-to-end anastomosis is the proper one to perform, but it has little application in gastric surgery. Even a Billroth No. 1 has its limitations.

In conclusion, we have found that while we can perform all anastomoses on the dog within certain limitations, their efficiency can well be compared to those performed in man.

Our limitations in performing gastrointestinal anastomoses on the dog are due to the fact that most of our dogs died when we performed a Billroth No. 2 operation.

The resistance of the dog can be enhanced if we perform a Billroth No. 1 first, and then at some future time perform a Billroth No. 2.

Dogs in which a gastroenterostomy has been performed without any resection survive the operation and grow fat after an efficient anastomosis.

Comparison of functional results only can be made between the anastomoses performed in the dog and in man.

In man all the various anastomoses performed for gastrointestinal conditions have been found efficient.

The efficiency depends on the placement and size of the stoma.

The massive resection of the stomach and the operation of the posterior gastroenterostomy have their field of usefulness in selected cases.

My thanks are due to Dr. Sidney Feldstein, radiologist to the Jewish Hospital and my co-workers, Drs. Clinton S. Herrman, Victor A. Loeb, Maurice Winston, and Morris Segal.

OPERATIVE RESULTS IN PARTIAL AND SUBTOTAL GASTRECTOMY FOR GASTRO-DUODENAL ULCERS

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FROM THE SURGICAL SERVICES OF MOUNT SINAI AND BETH ISRAEL HOSPITALS

THIS paper is a report of my operative results following partial and subtotal gastrectomy for gastro-duodenal ulcers.

I have two reasons for presenting this subject at the present time.

(1) For many years I have been a strong advocate of these radical procedures and have expressed my views on this subject in a number of papers.^{1, 2, 3, 4, 5, 6, 7} I have claimed repeatedly that the mortality following partial and subtotal gastrectomy in gastro-duodenal ulcers compares favorably with the death rates following conservative measures. Having used this procedure as the method of choice for six years I feel that sufficient time has elapsed to prove this claim by a statistical report.

TABLE I
Mortality in sixty-nine cases of primary and secondary gastric resections

Total mortality (primary and secondary Operations):.....	69 cases	12 + *	(17%)
Mortality—primary operations, (including acute bleeding ulcers):.....	56 cases	6 +	(10%)
Mortality—chronic ulcers:.....	51 cases	4 +	(7%)
Billroth I: 1923.....	3 cases	0 +	
Finsterer: 1923.....	2 cases	1 +	
Antecolic B II: 1922 and 1923:.....	2 cases	2 +	
Retrocolic B II: 1920-1928:.....	44 cases	1 +	
Mortality—retrocolic B II chronic ulcers.....	44 cases	1 +	(2, 27%)

* + = died.

(2) For a number of years I held the position of Associate on the Service of Dr. A. A. Berg. The gastro-enterological surgical cases are grouped on his division. Inasmuch as I assumed charge of another division last year, I have had no opportunity to add to my material during 1929.

Statistical reports often fail to give a true picture of the mortality rates since the author confines his review of personal cases to recent years. The reader marvels at the remarkably low mortality and gets the impression that the operation described by the author is practically without risk. A more correct picture is obtained, if the author reviews all his cases and shows the higher mortality rates which were encountered until he had standardized his technic.

A complete list of my cases of partial and subtotal gastrectomy for gastro-duodenal ulcers is presented in Table I. Both primary and secondary opera-

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tions are included in this survey. In some of the earlier cases operative methods were employed which were soon abandoned, as the results were most unsatisfactory. I have performed sixty-nine partial and subtotal gastrectomies for ulcer. Fifty-six cases were primary operations, thirteen were secondary operations. Sixty cases were operated at Mount Sinai Hospital, nine cases at Beth Israel Hospital. Five cases were operated during or immediately after a profuse haemorrhage. Among the fifty-one resections for chronic ulcers twenty-three were gastric, three pyloric and twenty-five duodenal ulcers.

Gastro-enterostomy with or without pyloric exclusion was used as the method of choice in the surgical treatment of duodenal ulcers up to 1923.

TABLE II
Primary operations for chronic gastro-duodenal ulcers

1) Billroth I:					
1. 1922: S. S.		2. 1923: J. M.		3. 1924: M. C.	
2) Finsterer Operation					
1. 1923: E. B.		2. 1923: L. W. +			
3) Antecolic Billroth II:					
1. 1922: H. M. +		2. 1923: E. C. +			
4) Retrocolic Billroth II:					
1. 1920: D. W.	12. J. S.	23. M. S.	34.	N. U.	
2. H. S.	13. A. K.	24. R. L.	35. 1927: H. T.		
3. 1921: M. C.	14. M. A.	25. J. R.	36.	C. G.	
4. J. F.	15. 1924: J. A.	26. S. G.	37.	M. K.	
5. 1922: O. S.	16. A. G.	27. L. E.	38.	B. W.	
6. D. B.	17. N. G.	28. 1926: F. G.	39.	J. B.	
7. 1923: B. S.	18. D. Z.	29. M. F.	40. 1928: H. S.		
8. S. P.	19. G. S.	30. H. L.	41.	J. L.	
9. A. G.	20. O. L.	31. M. L.	42.	A. H.	
10. S. T.	21. 1925: M. F.	32. H. L.	43.	M. G.	
11. L. S.	22. J. L.	33. M. S.	44.	J. B. +	

Thus the gastric resections reported during 1920, 1921, and 1922 were performed for gastric ulcers. After Haberer reported his results with resection of the stomach in duodenal ulcers and after a visit to his clinic in Innsbruck, partial gastrectomy was performed, whenever technically feasible, both for gastric and duodenal ulcers.

A perusal of Table II brings out a point of importance. During the first year after the adoption of partial and subtotal gastrectomy for both gastric and duodenal ulcers various procedures were tried in order to determine the best type of gastric resection. Thus during 1923 four different methods (Billroth I, Finsterer Operation, Antecolic and Retrocolic Billroth II) were tested. It soon became evident not only from this comparatively small group, but from the much larger material of Doctor Berg, that at least in our hands the Billroth II yielded the best operative and clinical results. I

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have therefore discarded all the other methods and consider the retrocolic Billroth II as the method of choice. Since the standardization of our technic (retrocolic Billroth II) the operative and clinical results have been excellent. Since 1924 nearly all cases were operated according to the Hofmeister technic (a variation of the original retrocolic Billroth II method). In a few instances the anastomosis was performed with the aid of a Murphy button. In very extensive resections for high gastric ulcers near the cardia the Murphy button presents the best procedure for a safe anastomosis.

The only exception to this rule was a Billroth I (Table II, 1) (1924: M.C.) which was operated through a right upper rectus incision for a suspected cholelithiasis. The gall-bladder was found to be normal. The patient was suffering from a duodenal ulcer. With the limited exposure at hand it was deemed advisable to perform a Billroth I.

The Billroth I anastomosis is apt to be comparatively narrow and thus interfere with the proper emptying of the gastric contents into the intestines. In the case just mentioned (M.C.) the obstruction was so marked that I had to perform a gastro-enterostomy seven days after the primary operation. At the secondary operation a large inflammatory tumor was found at the site of the anastomosis.

Furthermore post-operative achlorhydria—a most important factor in the prevention of secondary ulcerations—is more apt to follow the Billroth II anastomosis than the Billroth I. In the Billroth II the line of gastric resection can be much higher than in the Billroth I. A comparatively high dissection of the stomach is of the utmost importance for the establishment of a post-operative achlorhydria.⁴

The Finsterer operation (gastric resection without the removal of the duodenal ulcer) cannot be recommended. It is undoubtedly a major procedure. Yet the duodenal ulcer and sometimes the pylorus are left in situ, thus making possible recurrent symptoms from the old ulcer or a recurrence from an ulceration at the stoma.

I have used the Finsterer operation during 1923 in two primary cases. One patient died on the day following the operation from cardiac failure. The other patient made an uneventful recovery.

In the rare instances in which primary resection of a duodenal ulcer on account of its deep location and on account of the involvement of the common duct would present too great a risk for the patient a simple retrocolic gastro-enterostomy is indicated, rather than the major operation of subtotal gastrectomy without the removal of the ulcer (Finsterer operation).

In secondary operations for gastro-jejunal or jejunal ulcer with a persistent deep duodenal ulcer the Finsterer operation may be a very useful procedure. Resection of the stomach with secondary reduction of the hyperacidity presents the only possible way to prevent a recurrent ulceration at the stoma. Yet the reserve of the patient may have been taxed too severely by the prolonged operation in dealing with the gastro-jejunal ulcer, that it may be advisable to desist from the excision of the duodenal ulcer. One

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patient (Table IV, 5) has died following the operation. The other two cases (Table IV, 2 and 4) have been perfectly well (observation time: five years).

Any statistical review of operative results should report those cases in which on account of the deep location of the duodenal ulcer and its marked adhesions to important neighboring organs simple gastro-enterostomy was performed. It is very evident that by reserving partial and subtotal gastrectomy for easily resectable ulcers, the mortality can be kept at a very low figure. It is of great importance that in a statistical report those cases should be mentioned in which on account of location (very high at the cardia or very low near the common duct) simple gastro-enterostomy was performed.

The vast majority of ulcers are resectable, though the operation may offer great technical difficulties. I did not find a non-resectable ulcer until 1927. Since then I was forced in two cases of deep duodenal ulcers to perform a gastro-enterostomy.

The antecolic Billroth II has not been used since 1923. I had used this method in two cases; both patients died from peritonitis. In both cases extensive resections were made and I felt at the time that the anterior anastomosis was preferable. I have since performed even more extensive resections by the retrocolic Billroth II method with perfect success. I feel sure that the post-operative peritonitis would not have occurred if the retrocolic route had been used. An antecolic anastomosis is apt to produce leakage, when the distended colon begins to press on the suture line. I would not use an antecolic anastomosis again, except in those very rare cases in which an anomaly or absence of the mesocolon prevents us from applying the retrocolic anastomosis.⁵

The retrocolic Billroth II method (either in the form of the Hofmeister anastomosis or with the aid of a Murphy button) has given excellent results in my hands. Between 1920 and 1928 forty-four cases were operated by this method with one death (Case No. 44). This patient had a very high gastric resection for an ulcer near the cardia and died eleven days post-operative from peritonitis in the upper abdomen. Post-mortem was not obtained. Thus we had forty-three consecutive cases without a death. I think that any method which gives a mortality rate of 2.27 per cent. can be recommended to the medical profession. In fact the mortality rate following resection of the stomach is slightly lower than the death rate following gastro-enterostomy in the years when gastro-enterostomy was used extensively on the service. Thus in spite of the fact that I have used the major operation of partial and subtotal gastrectomy, the mortality rate was not increased.

I have always felt that the opposition against partial and subtotal gastrectomy really centers around the question of post-operative mortality. Many other arguments have been brought forward in favor of more conservative procedures. Yet I am sure that resection would become very popular, if a low mortality were assured. My experience shows that with the retrocolic Billroth II method the mortality rate for partial and subtotal gastrectomy can be held to a very low level.

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I am well aware of the fact that some of the methods which I discarded many years ago are extensively used in other clinics with good results. However, the purpose of this presentation is to give my personal experience with different methods.

This paper deals mainly with operative results in chronic gastro-duodenal ulcers. Therefore I shall only refer very briefly to results in bleeding gastro-

TABLE III
Operations for bleeding gastro-duodenal ulcers

No.	Year	Name	Diagnosis	History	Operation	Result
1	1923	M. M.	Bleeding gastric ulcer	Nov. 14th, admitted to medical service following profuse gastric hemorrhage. Sent home after two weeks. Dec. 4th: Recurrence of hemorrhage. Hæmoglobin 54	Dec. 5th: Subtotal gastrectomy (button) operation—local anesthesia.	Died at end of operation when gas was given for closure of abdominal wall. Post-mortem: luetic aortitis; coronary artery sclerosis.
2	1924	A. K.	Bleeding duodenal ulcer	July 1924, exploratory gastrotomy for duodenal ulcer (author). Negative findings. Discharged Aug. 16th. Readmission Aug. 31st for recurrent symptoms. On day of re-admission profuse hemorrhage. Hæmoglobin down to 42. Transfusion. Hæmoglobin (pre-operative) 60.	Nov. 5th: partial gastrectomy (Hofmeister).	Cured.
3	1926	B. G.	Bleeding duodenal ulcer	Admitted after profuse hemorrhage. Hæmoglobin 26 per cent, red blood corpuscles 2,500,000. Hæmoglobin raised by two transfusions to 45.	Partial gastrectomy (Hofmeister).	Cured. Long persistent secondary anemia.
4	1926	J. de G.	Bleeding duodenal ulcer	Long history of epigastric distress. Profuse hemorrhage five days before admission. Admitted June 2nd. Hæmoglobin twenty-five per cent. Operation July 14th; hæmoglobin at time of operation 37 per cent.	Partial gastrectomy (Hofmeister).	Cured.
5	1926	S. L.	Bleeding duodenal ulcer	1922: treated medically for duodenal ulcer in this hospital. Refused operation. Nov. 22, 1926: re-admitted to medical service. Nov. 23: profuse hemorrhage. Hæmoglobin 49. Operation: Nov. 26th: Blood pressure before operation: 70/58.	Partial gastrectomy (button).	Died 16 hours after operation

duodenal ulcers and secondary operations for recurrent gastro-duodenal or gastro-jejunal and jejunal ulcers.

These eighteen cases are abstracted in Tables III and IV. Profuse gastric hemorrhage is a very serious complication of a chronic gastro-duodenal ulcer. We prefer to wait until the patient is restored to normal health. However, some cases require immediate operation. The statement that gastric hemorrhages are not fatal and cease spontaneously is certainly incorrect.

Two patients died following the operation; one patient succumbed sixteen

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hours later; the other died on the operating table. This death must be considered as an anaesthesia death. The patient who had withstood the operation under local anaesthesia perfectly well died suddenly, when gas-oxygen was administered for closure of the abdominal wall. Post-mortem examina-

TABLE IV
Secondary operations

No.	Year	Name	Previous Gastric Operations	Operation	Result
1	1922	M. H.	1918: gastro-enterostomy by another surgeon. 1919: division of adhesions (author).	Billroth I for mal-functioning stoma. Secondary jejunostomy.	Died
2	1923	J. W.	1) Gastro-enterostomy. 2) Exploratory laparotomy for bleeding duodenal ulcer; both performed by another surgeon.	Finsterer for bleeding duodenal and gastro-jejunal ulcers.	Well
3	1923	S. N.	Excision and cauterization of gastric ulcer, performed by another surgeon. Immediate recurrence.	Billroth II (button) for recurrent gastric ulcer. Four-fifths of stomach removed.	Well
4	1923	A. Z.	1913: gastro-enterostomy (Boston). 1915: appendectomy (Boston). July, 1923: excision gastro-jejunal ulcer. Disconnection stoma (author). Post-operative complication: lung abscess. Recurrence of duodenal ulcer. Dec., 1923: re-operation.	Finsterer for recurrent duodenal ulcer.	Well
5	1925	J. M.	1918: appendectomy (Post-Graduate Hospital). 1921: gastro-enterostomy (Hartford). 1924: exploratory laparotomy (Hartford).	Finsterer for gastro-jejunal and duodenal ulcer.	Died
6	1925	L. S.	1918: gastro-enterostomy and pyloric exclusion for duodenal ulcer (author).	Billroth II for jejunal ulcer.	Well
7	1926	B. E.	1920: gastro-enterostomy for pre-pyloric ulcer by another surgeon. 1921: re-laparotomy. Division of adhesions by another surgeon.	Billroth II formal-functioning stoma and pre-pyloric ulcer. Secondary cholecystostomy for acute cholecystitis. 1928: cholecystectomy for cholelithiasis.	Improved
8	1927	N. D.	1917: gastro-enterostomy and pyloric exclusion for duodenal ulcer by another surgeon. 1925: excision gastro-jejunal ulcer. Removal exclusion stitch. Disconnection gastro-enterostomy. Entero-enterostomy by the same surgeon.	Billroth II for penetrating duodenal ulcer. Secondary entero-enterostomy.	Died
9	1927	C. L.	1926: gastro-enterostomy for duodenal ulcer (Fordham Hosp.). 1926: excision of gastro-jejunal ulcer. Disconnection of stoma. Finney pyloroplasty (Fordham Hospital).	Billroth II for duodenal ulcer.	Died
10	1927	M. G.	1927: suture of perforated pyloric ulcer by another surgeon.	Billroth II for recurrent ulcer.	Well
11	1927	S. G.	1925: excision of duodenal ulcer. Appendectomy (San Diego).	Billroth II (subtotal) for recurrent duodenal ulcer.	Died
12	1927	A. G.	1924: antrumectomy for duodenal ulcer (author). 1927: acute perforation of gastro-jejunal ulcer.	Billroth II (subtotal) for perforated gastro-jejunal ulcer.	Well
13	1927	D. G.	1918: gastro-enterostomy for gastric ulcer by another surgeon.	Billroth II for jejunal ulcer.	Died

tion show extensive luetic aortitis and coronary artery sclerosis. The three cases which survived operation had a haemoglobin of 37, 45 and 60 per cent at the time of operation. These cases of profuse haemorrhage are an indictment against prolonged medical treatment and show the risk which these

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patients incur. All these patients had a long ulcer history and repeated courses of medical treatment.

Partial and subtotal gastrectomy was the only possible procedure in the attempt to cure these patients. Yet gastric resection in these desperately sick patients must be associated with a high mortality. It is evident that this group of cases offers an entirely different surgical problem from the chronic gastro-duodenal ulcers.

Table IV presents thirteen cases of secondary operations with six deaths. Details of the previous operations are given on this table. Eight cases had two or three previous operations. Five cases were operated for gastro-jejunal or jejunal ulcers, six cases for recurrent gastric or duodenal ulcers and two for mal-functioning stoma. It is a well-known fact that secondary operations, especially those for gastro-jejunal or jejunal ulcers, often present the greatest technical difficulties.

This table shows very well the marked differences as to operative risks in primary and secondary operations. It has been stated many times that gastro-enterostomy should be the operation of choice at the time of the primary operation and that resection should be reserved for recurrent ulcers. The good results reported above by the retrocolic Billroth II method in primary resections for chronic gastro-duodenal ulcers and the high mortality following secondary operations present a strong argument in favor of primary partial and subtotal gastrectomy in gastro-duodenal ulcers.

CONCLUSIONS

1. The retrocolic Billroth II method is the best procedure for partial and subtotal gastrectomy in chronic gastro-duodenal ulcers. One death occurred among forty-four cases (mortality 2.27 per cent.).
2. Medical treatment should be given only over a limited period.
3. Early operation is advisable in order to prevent serious complications such as perforation and haemorrhage.
4. In order to reduce the number of secondary operations, which are followed by a high mortality, partial and subtotal gastrectomy should be performed as the primary operation for gastro-duodenal ulcers.

BIBLIOGRAPHY

- ¹ Lewisohn: Resection of Stomach for Chronic Gastric and Duodenal Ulcer. *ANNALS OF SURGERY*, vol. lxx, p. 507, 1923.
- ² Frequency of Gastro-jejunal Ulcers. *Surg. Gyn. and Obst.*, vol. xl, p. 70, 1925.
- ³ Lewisohn and Feldman: Failure of Gastro-enterostomy to Effect a Decisive Reduction in Gastric Acidity. *ANNALS OF SURGERY*, vol. lxxxii, p. 925, 1925.
- ⁴ Lewisohn and Ginzburg: Relation of Post-operative Achlorhydria to the Cure of Gastric and Duodenal Ulcers. *Surg. Gyn. and Obst.*, vol. xliv, p. 344, 1927.
- ⁵ Gastro-duodenal Ulcers. *J. A. M. A.*, vol. lxxxix, p. 1649, 1927.
- ⁶ Late Results in Perforated Gastro-duodenal Ulcers. *ANNALS OF SURGERY*, vol. lxxxvii, p. 855, 1928.
- ⁷ Factors of Safety in Resection of the Stomach for Gastro-duodenal Ulcers. *ANNALS OF SURGERY*, vol. xc, p. 69, 1929.

CURLING'S ULCER

DUODENAL ULCER FOLLOWING SUPERFICIAL BURNS

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CASE HISTORY.—A white boy of eleven years was admitted to my service at Touro Infirmary August 26, 1929, with superficial first-degree burns from gasoline, which involved both lower extremities from the ankle to the junction of the middle and upper third of the thigh. The previous history was irrelevant. On admission his temperature was 96.5° and his pulse 90. The following day they rose respectively to 100.8° and 160, and there was evidence of a severe toxæmia, with vomiting of all food, involuntary voiding and extreme delirium. Under local and constitutional treatment there was progressive improvement until September 2, when he complained of generalized abdominal pain, which was somewhat relieved by an enema. Shortly thereafter he vomited blood-stained material, and macroscopic blood was observed in the stools. Blood study at this time showed 3,240,000 red cells, 29,100 leucocytes, and 67 per cent. polymorphonuclears. Urinalysis was essentially negative, the trace of albumin evident on admission having disappeared. The blood-pressure was 100/64; September 3, copious haemorrhage from the bowel having continued, it fell to 88/0. On that day the abdomen, which had been quite soft, gradually became distended and tender, and tympanites was marked. Transfusion was done and repeated the following day, 250 cubic centimetres of citrated blood being given each time. The first injection resulted in some improvement in the general condition, but shortly after the second the patient became wildly delirious, the bowels moved involuntarily with profuse haemorrhage, although there was no further vomiting, and death ensued within a few hours.

Autopsy, which was done immediately, was essentially negative except as regards the gastrointestinal tract, the spleen and the kidneys. The latter organs showed acute splenitis and acute glomerulo-nephritis. The jejunum and ileum were both distended, and the ileum was full of blood. A small purplish-brown area, about 1/2 centimetre in diameter, was discovered at the junction of the first and second portions of the duodenum, and examination of the mucosal surface showed a small ulcerated area, about 3/4 centimetre in diameter, about to perforate, at the outer margin of the descending portion. Another larger but more superficial area, which involved only the mucosa, was evident at the same level in the posterior wall, and was considered to be a contact or "kissing" ulcer.

I am aware of the pitfall of reporting single cases, but I think circumstances such as these justify the act. This boy died from a disease which I knew could exist as a complication of burns, indeed which I had encountered at least once before, but which, because it was unusual, I failed to diagnose, in spite of the definite evidence that gastrointestinal pathology was present. Whether he could have been saved with the proper treatment I cannot say. Perhaps not. But that does not lessen my responsibility, and my failure to identify accurately an unusual but perfectly possible disease is my excuse for presenting this report.

Curling's ulcer is very largely an unknown lesion. If it is mentioned at all in the textbooks the description is of a very cursory character. This is partly due to the fact that it is seldom recognized during life, partly because

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its incidence, as I shall point out shortly, is variable and rather low, and chiefly, I think, because it is most frequent in children, whose symptoms are notoriously vague and in whom it is easy to overlook the diagnosis of even more usual conditions.

Curling in 1842 first described duodenal ulcer associated with burns as a clinical entity, though he himself admits that Dupuytren, some ten years before, had called attention to ulceration of the intestines as a late finding in patients who survive the immediate effects of the injury. Curling, however, definitely localized the lesion in the duodenum, though for the sake of historical accuracy we might add that contributions to the subject had been made by Cumin in 1823, by Cooper in 1840 and by Long in the same year, and that Erichsen wrote a comprehensive paper upon it in 1843.

Curling, in the treatise which he read before the Royal Medico-Chirurgical Society, reported ten cases, four of which he had seen personally. The ulceration, as he described it, is of an acute character, the immediate cause of death being perforation with consequent peritonitis in three of his cases and haemorrhage in six. One patient survived five weeks, the others died in from seven to seventeen days. He also described three other cases, one seen personally, in which post-mortem examination showed a definite increase in vascularity as well as definite inflammation of the duodenum, though there was no destruction of substance. Finally, he described a cicatrized duodenal ulcer from the collection in the Hunterian Museum; this was exhibited in the body of a young woman who had died of exhaustion eight weeks after a burn, and is unquestionably of the same type.

It is nearly a century since Curling established the sequence of burns and duodenal ulcers, yet there is still no uniformity of opinion as to the incidence of the lesion. Erichsen, a year after Curling's identification, found them in two of twenty-eight fatal cases. Ronchesi found them in one of 348. Fenwick states that they are present in 6.2 per cent. of all deaths from burns, while Holmes, in 125 cases, reports an incidence of sixteen, 12.8 per cent. Harris, with an experience of 567 cases and 138 deaths over a twelve-year period, found only one case. Levin, reporting for himself, his predecessor and two of his associates, with fifty composite years of service at Johannesburg, and with an experience of fully 12,000 autopsies, found only two cases, and those when he had begun to believe that the lesion was merely a medical myth. Bancroft and Rogers found none in 104 cases, and likewise seem doubtful of the existence of the disease. The indices of the New Orleans Charity Hospital show not a single instance, although this institution has probably the largest accident service in the South. The case I have reported is the only one recorded at Touro Infirmary. Are these ulcers decreasing in incidence, or are we simply failing to find them because we do not look for them? My own experience inclines me to the latter view.

Such ulcers are commonest in children, the average age in Curling's series being 10.8, and all but two of his patients being under 15. They are usually considered a late complication, but as a matter of fact, and as the literature

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evidences from the beginning, they may occur at any time. Levin mentions Parfick's case, quoted in Choyce's *System of Surgery*, in which the ulcer was evident eighteen hours after injury, and in Harris's case death ensued on the third day, perforation, as the autopsy showed, having already occurred. In many instances, however, the lesion develops during the third or fourth week of illness, when the patient has apparently recovered from the critical stage of the injury. In Simpson's case the intestinal symptoms developed at the end of one hundred days, when the local condition was progressing to recovery. In spite of the epigastric pain, I am doubtful whether this patient really had a duodenal ulcer, though the intestinal ulceration is beyond question.

The symptoms, as Curling names them, include pain and tenderness to pressure on the right side, midway between the cartilage of the ribs and the umbilicus, uneasy digestion and vomiting. When ulceration ensues, the stools are dark and bloody. In very acute instances, either haemorrhage or perforation may be the initial sign, and there may be no symptoms at all, as in one of Levin's cases, in which death was definitely due to pneumonia, and in which, in spite of a complete lack of ante-mortem symptoms, the autopsy disclosed a typical ulcer which had evidently just perforated. In short, the symptomatology and clinical course are akin to those of the ordinary chronic or acute peptic ulcer. Curling is quite correct when he points out that the morbid action, however acute it may be, is deep-seated and limited in extent, as well as masked by the general derangement. The pathology of the burn itself—which is the pathology we look for and expect—dominates the clinical picture, and again I revert to my thesis, that only by bearing in mind the possibility of the unusual complication can we be certain of not overlooking it.

The etiology of Curling's ulcer, as is the case with other peptic ulcers, is still an unsolved problem. The burn, of course, introduces certain special considerations, for in addition to the local pathology there are inevitable systemic and constitutional complications. Severe burns are characterized primarily by pain and shock. Following these there is evident a profound toxæmia, decidedly more marked in children, which, by its effect on the central nervous system, may result in hyperpyrexia, vomiting, drowsiness and convulsions. Finally, there may be exhibited such complications as pneumonia, nephritis, or the protean manifestations of infection, the latter being especially evident in improperly treated cases.

Curling's theory of the etiology of these ulcers, considering the limited medical knowledge of the day, is rather an ingenious one. Congestion of the mucous membrane, he says, is an insufficient explanation, because the remainder of the alimentary tract, although participating equally in the vascular disturbance, rarely becomes affected. The glands of Brunner, however, he found enlarged and infiltrated in at least one fatal case, and his idea was that the sudden arrest of the important functions of the skin rouses in these glands an endeavor, by increased action, to compensate for the suppression of dermal exhalation, the irritation from hyperactivity leading eventually to inflamma-

tion and ulceration. The specific localization is thus explained, and the haemorrhagic feature is due to the fact that if perforation does occur, the arteria pancreatico-duodenalis, because of its position, necessarily becomes exposed. This theory he considered confirmed by the fact that the disease, if not fatal, goes on to recovery when the functions of the skin are re-established, though he apparently failed to see that it does not explain the fairly frequent cases in which the ulcer does not exhibit itself until the local condition is progressing toward recovery.

In more modern days Cooke and Falk have advanced as a cause a reflex inhibition of the intestinal circulation, Falk adding that the depressed action of the heart or the impaired nourishment of the mucous membrane is a predisposing factor. Billroth and Moynihan consider it an embolic process, Moynihan pointing out that the ulcer never occurs without septic changes in the burn. Simpson and others consider it due to a sort of ante-mortem digestion, that part of the mucous membrane being affected in which the circulation has been arrested by congestion or embolism.

The consensus of modern opinion regards the toxæmia of burns rather than the circulatory disturbance as responsible for the production of the associated duodenal ulcers. Certainly, since the toxæmia is most marked in children, this would explain their most frequent incidence in young subjects. According to Hunter, a toxic substance is elaborated in the burned tissues and excreted in the bile, and he was able to produce such ulcers experimentally in dogs by the injection of toluylenediamin. Fenwick, on the other hand, could not produce them by tying the common duct, and Busse produced general intestinal as well as duodenal ulceration and haemorrhage by the injection of extracts elaborated from the burned areas of the skin. DaCosta is opposed to Hunter's theory on the ground that the typical ulcer occurs well above the ampulla of Vater. Catiano and Harris advance rather similar theories, to the effect that the action of the toxin, by reducing the natural alkalinity of the intestinal wall, causes focal necrosis and haemorrhage, the areas being transformed into ulcers by the action of the pancreatic juice. Levin's theory is along the same lines. He believes that the shock incident to all burns causes either a true or a relative hyperacidity and hypoalkalinity, that the special toxin of burns is a substance which may be akin to histamine, and that the combination of hyperacidity and the devitalizing effect of the toxin on the mucous membrane favors the development of the ulcer. The specific localization he explains, as all duodenal ulcers may be at least partially explained, by the tortuosity of the vessels of the lesser curvature of the stomach and the first part of the duodenum, their relatively poor anastomosis rendering them more liable to thrombosis. This, of course, is in keeping with the well-known demonstration of Wilkie, amply corroborated by Finney, of the rôle played by the superior duodenal vein in most peptic ulcers involving the first portion of the duodenum.

All theories fail, I might remark, to explain the case reported by Leonard and Dayton. Post-mortem examination of a patient with cervical carcinoma

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who had been treated by the Percy method revealed a typical Curling ulcer. Since the skin factor is entirely lacking here, no explanation yet advanced fits the case.

It has long been recognized that while these ulcers might exist anywhere in the intestinal tract, they were most common in the first portion of the duodenum, but it remained for Pack, in 1926, to describe the histopathology definitely. They may vary in size, he says, from a pinhead to a quarter, and the amount of tissue loss depends on whether the lesion is a mere erosion or a rapidly sloughing perforative process. The ulcer is frequently funnel-shaped, due to loss of more mucous membrane than muscle tissue, and the shape may be irregular and dentate, long and narrow, or, less often, circular. The edges are sharply and cleanly cut, and the base is clean and grayish, though, in the rare instances in which the lesions tend to chronicity, the edges may be indurated and there may be some inflammatory reaction about the margin. Lymph and fibrinous exudation may be seen on the peritoneal surface, as a pre-formed and protective barrier to the lethal progress of the disease if perforation threatens. The factor of time may exert some influence on the depth of penetration, but the age cannot be accurately estimated from this, since the lesion is so insidious and so asymptomatic in its incipiency as to elude diagnosis. The outcome is perforation, haemorrhage or spontaneous healing.

As a remote result of a healed duodenal ulcer of the Curling type, I quote the following case: Early in my practice I treated a white male, then aged forty-eight years, for extensive burns of the chest, epigastric region and both legs, the recovery being complicated by lobar pneumonia, and by definite symptoms of a duodenal ulcer. At the age of sixty-five he consulted me again, complaining of various digestive disturbances which rather suggested gall-bladder pathology, though in view of his age malignancy had to be considered. He refused operation. Three years later, at sixty-eight years, he returned again, this time with a history of recent acute digestive symptoms, constant epigastric pain, very marked loss of weight, in short, the whole symptom complex of gastric malignancy. Exploratory incision revealed inoperable carcinoma of the upper abdomen, with extensive retroperitoneal metastases. There was definite pyloric infiltration. Nothing could be done for his relief, and he died of inanition two weeks later. There is little doubt in my mind that in this instance the carcinoma was superimposed upon the old cicatrix, and the chain of events raises the question of whether the Curling variety of ulcer, unlike the usual duodenal ulcer, predisposes to malignancy.

In no case of Curling's ulcer reported in the literature, so far as I can ascertain, was the specific lesion treated. It was either revealed at post-mortem, there being no suspicion of its previous existence, or the patient recovered spontaneously. But such therapeutic nihilism is obviously without justification. Curling stated in his paper that in any case which in the future he should recognize during life, he would apply leeches to the skin

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of the corresponding part of the abdomen, and would give mercury and chalk, with opium for pain, and bland fluid nourishment. We have no record of whether the treatment he outlined was ever applied, and in any event it is not a regimen suitable today for any sort of ulcer. For my own part, in another case of bleeding ulcer such as I have reported, I shall be tempted to resort to surgery, as I should resort to it for other bleeding peptic ulcers. Transfusion availed nothing, and surgery, even though the boy was a frankly poor risk, might have saved his life. In the non-acute type of ulcer, prophylactic excision might be justified, even in seriously burned patients, where the risk would be very high, to avoid the possibilities—which are not remote—of perforation or haemorrhage. The exact procedure, however, is beside the point. My premise is that something should be done. There is no justification, in this epoch of medical achievement, for permitting patients to die from a disease in which, if it were promptly diagnosed and properly treated, they might have at least a chance of life.

SUMMARY

1. Ulcer of the duodenum, described in 1842 by Curling as a complication of burns, has an estimated incidence in fatal cases of 6 per cent. or more, and occurs most frequently in young children.
2. Its symptomatology and clinical course do not differ from those of the ordinary peptic ulcer, but its existence is prone to be overlooked in the severe constitutional and systemic manifestations which follow burns.
3. The etiology is still unsettled, but the theory of a toxæmic origin seems more reasonable than the theory of a circulatory origin.
4. The histopathology has recently been comprehensively described by Pack.
5. The literature contains no treatment for this type of ulcer, and it is suggested that at least in some cases surgery, as applied to the ordinary peptic ulcer, would seem to warrant a trial.
6. Two additional cases are reported, one in a boy, with fatal result, the other in a patient who recovered and who, twenty years later, died of carcinoma, probably superimposed upon the site of his original ulcer.

BIBLIOGRAPHY

- Bancroft, F. W., and Rogers, C. S.: *Trans. Am. Surg. Assoc.*, vol. xliv, p. 258, 1926.
Curling, T. B.: *Med. Chirur. Trans.*, vol. xxv, p. 260, 1842.
Harris, R. I.: *Brit. Jour. Surg.*, vol. xvi, p. 677, 1929.
Levin, J. J.: *Ibid.*, vol. xvii, p. 110, 1929.
Leonard, N. V., and Dayton, A. B.: *Surg. Gynec. and Obst.*, vol. xxiv, p. 156, 1917.
Novak, E.: *Am. Jour. Med. Sci.*, vol. clxix, p. 119, 1925.
Pack, G. T.: *Arch. Pathol. and Lab. Med.*, vol. 1, p. 767, 1926.
Simpson, J. C.: *Brit. Med. Jour.*, vol. ii, p. 1875, 1889.

DUODENITIS AND DUODENAL ULCER*

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IN MANY cases of duodenal ulcer, in which clinical symptoms and röntgenograms are indicative of ulcer, a definite lesion cannot be found; instead there is a more or less localized thickening of the wall of the duodenum even with some stippling and scarring of the serosa. It is my purpose to describe the excised material and to demonstrate the entity, duodenitis, and its possible relationship to duodenal ulcer.

My observation is based on more than 200 excised specimens from which frozen sections were made; the fresh sections were stained with polychrome methylene blue and the formalin-fixed sections were stained with haematoxylin and eosin. The excised tissue was all from the first portion of the

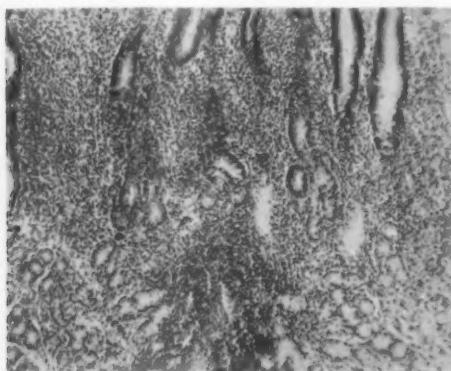


FIG. 1.—Duodenitis (x 75).

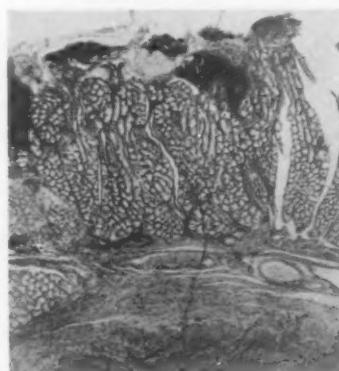


FIG. 2.—Chronic duodenitis (x 25).

duodenum and varied from slight thickening of the duodenum to a typical perforating type of ulcer. In some instances the lesions were multiple. Age, sex, and length of history varied and the clinical¹⁶ and röntgenographic⁵ data always leaned toward the diagnosis of ulcer.

By the term ulcer is usually meant dissolution or a break in the continuity of tissue, with a crater of variable depth and shape which is composed of fibrous and inflammatory tissue extending to the submucosa, muscularis propria, and serosa. Irregular shallow areas of dissolution involving the mucosa, or the mucosa and muscularis mucosæ are usually spoken of as erosions and ulcerations. Erosions especially are characterized by absence of fibrosis in the base and margins. The histologic picture of a chronic duodenal ulcer is similar to that of chronic gastric ulcer.¹⁹

Much has been written on the etiology of peptic ulcer. The older pathol-

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ogists stressed the idea of infarcts and thrombosis which no doubt were found occasionally in specimens at necropsy and were usually chronic. In the literature and in most textbooks acute ulcers of the stomach and duodenum receive little attention and are sometimes completely ignored. Cruveilhier² initiated the idea that a chronic ulcer arises from an acute variety, the beginning lesion being inflammation of a solitary follicle with its subsequent rupture and circumscribed area of inflammation with necrosis and haemorrhagic erosion. Virchow¹⁸ originated the idea that spasm of the muscular coats of the stomach or portal stasis might cause haemorrhagic infiltration into the mucous membrane, with resulting ulcers. These minute extravasations might be caused by vascular spasm, congestion, or bacterial infection.

Inflammation of the duodenum with and without erosion may be caused by a single factor or a combination of factors, as trauma from within and without, high temperature (heat), strong acids or alkalies, vascular disease, emboli, functional disturbances and allergic reactions.⁹ Inflammation and ulcer of the duodenum have been produced experimentally by many workers in various ways.^{12, 14, 17} Stasis may play an important part in the production of lesions of the duodenum and may be brought about by periduodenitis, the shape and angulations of the duodenum, compression, or duodenal atony. Stasis of the chyme causes irritation of the mucosa and furnishes an excellent culture medium for the development of any existing organisms.¹⁵ Normal bile can disinfect the duodenal contents and likewise infected bile can infect it and at the same time cause a change in the reaction of the chyme. This may explain the frequent association of duodenal ulcer in biliary disease and biliary lithiasis. The part that heredity and constitutional make-up play must not be overlooked for ulcers are often seen in certain families and in certain types of persons.

The relationship of duodenitis and gastritis to duodenal ulcer and gastric ulcer has been rather thoroughly considered by Hauser,³ Konjetzny,⁶ and Konjetzny and Puhl.^{7, 8} Konjetzny, and Konjetzny and Puhl based their arguments on observations on freshly resected material. The many clinical, pathologic, and experimental studies from the time of Virchow to the present were thoroughly considered by these authors, but they did not reach any definite or convincing conclusions. However, Konjetzny and Puhl contended that inflammatory erosions are the forerunners of ulcers in the duodenum and stomach.

Inflammation of the duodenal wall may be localized to the mucosa or it may involve all of its coats. In mild cases the mucosa is infiltrated with a few lymphocytes, an occasional polymorphonuclear leucocyte and some congestion of the capillaries. There is some hyperplasia of Brunner's glands and in some instances slight thickening with diffuse fibrosis of the muscularis propria. Brunner's glands normally exist in the duodenum above and below the muscularis mucosæ, sometimes occupying the entire submucosa, and are more numerous in the first portion. In more advanced cases the mucosa contains a larger number of polymorphonuclear leucocytes, collections of

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lymphocytes, some plasma cells and eosinophiles. In some cases there are one or more small erosions in the mucosa producing a ragged appearance with adherent mucus and débris. This more acute or subacute inflammatory process is usually confined to the mucosa and submucosa. The submucosa is oedematous and contains lymphocytes and a few mast cells. The glands of the duodenum show activity in the presence of inflammation by the occurrence of numerous regenerative cells and mitotic figures. The muscularis is intact but is infiltrated with lymphocytes and a variable amount of fibrous connective tissue. The serosa is usually only slightly thickened. Brunner's glands are distinctly more numerous and in the less acute lesions lie among intervening fibrous connective tissue. Throughout all layers may be seen small collections of lymphocytes without any germinal centre. Blood-vessels are moderately sclerosed but not obliterated. In the more chronic forms there is more fibrous tissue throughout, fewer polymorphonuclear leucocytes

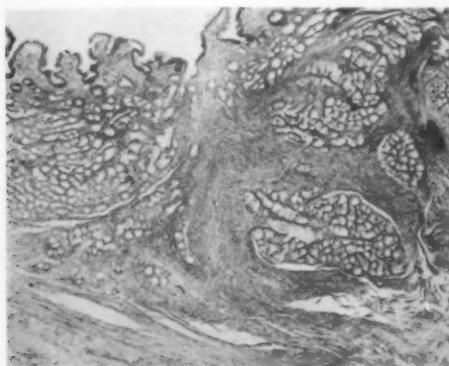


FIG. 3.—Healed duodenitis ($\times 25$).

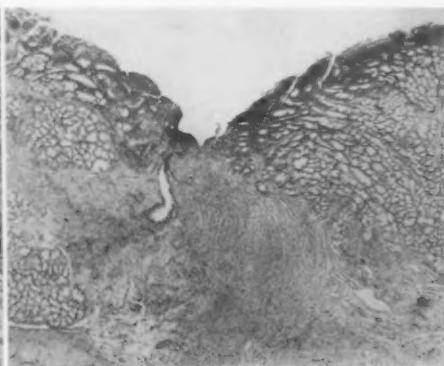


FIG. 4.—Healed duodenal ulcer with heterotopic gland in scar ($\times 25$).

in the mucosa, with definite germinal centres, less glandular epithelial activity and more interlobular fibrosis among Brunner's glands. Occasionally there is dilatation of both types of glands. In some of these chronic forms of duodenitis or ulcerated duodenitis the gross section looks like an ulcer but on closer examination there is a moth-eaten appearance instead of a regular punched-out crater. W. J. Mayo¹⁸ noted this difference in the ulcers he excised from the anterior wall as compared to those in the posterior wall and in the stomach.

In chronic duodenitis there is no distortion of the musculature and the mucosa contains lymphocytes, plasma cells, and eosinophiles. Large collections of lymphocytes and germinal centres are also present. Brunner's glands are distinctly increased in number, with definite interlobular fibrosis. This may grossly simulate a scar of a healed ulcer.

In many cases healed ulcerative duodenitis closely resembles a small healed ulcer. There is marked hyperplasia of Brunner's glands on each side of a scarred area in the mucosa and submucosa without distortion or extensive involvement of the muscularis propria. In this area are mucosal glands and

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Brunner's glands, infiltrated with lymphocytes. In the ulcer there are no glands and the surface is covered by a single layer of epithelium. The muscularis is more involved and slightly cocked owing to the separation of the muscularis and its blending with the submucosa and muscularis mucosæ. In both conditions the mucosa and also the other layers contain a variable number of large germinal centres. The blood-vessels are sclerosed and sometimes nearly obliterated. The serosa is variable in thickness.

The typical true duodenal ulcer is similar to the gastric ulcer. The crater is composed of dense fibrous tissue, the muscularis being completely retracted and blended upward with that of the submucosa and muscularis mucosæ. Nearer the surface is granulation tissue consisting of young connective tissue with well-formed small blood-vessels, and on the surface débris, mucus, lymphocytes, polymorphonuclear leucocytes and bacteria. The shape, size and depth of the crater varies. On either side the submucosa is thickened, oedematous or completely obliterated. There is a distinct increase in number of Brunner's glands with fibrosis between the lobules. If the ulcer is in the pyloric ring this will be noted on the duodenal side only. Throughout all the coats are lymphocytes, both scattered and in collections, with oftentimes a germinal centre. In the mucosa are found also plasma cells, eosinophiles and a few polymorphonuclear leucocytes. In the less chronic conditions there is much activity of the glandular epithelium, as evidenced by the presence of regenerative cells and many mitotic figures.

Duodenal lesions are most common in the first portion of the duodenum. Sometimes on exploration stippling and scarring of the serosa is not found but on opening the duodenum dimpling, ulceration or thickening is noted. There may be multiple lesions, one or more of which have a typical crater. Such observations would suggest generalized disease of the duodenum and would also indicate that all lesions should be treated. Duodenitis and duodenal ulcer may not always be local because of their frequent association with pathologic conditions elsewhere in the body.

In the specimens studied I have observed in only one case, that of duodenitis with erosion, an infarct or recent thrombus. In the base was a small vessel recently thrombosed, which may have been an infarct causing the ulceration. In a few specimens, minute follicular ulcers were present which evidently were due to the explosion of an inflammatory hyperplastic solitary lymph node. I have noted similar microscopic ulcerations in appendices which were acutely or subacutely inflamed.

There seems to be some relationship between duodenitis or inflammation of the duodenal wall and the true typical duodenal ulcer.¹¹ In the moderately thickened duodenal wall the mucosa is infiltrated with lymphocytes, plasma cells and polymorphonuclear leucocytes, with congestion of the capillaries and even with some extravasation into the delicate stroma, thereby producing minute haemorrhagic erosions. The glandular epithelium may show some activity by the presence of a larger number of regenerative cells and a few mitotic figures. The submucosa is usually oedematous, and Brunner's glands

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are increased in number, both above and below the intact muscularis mucosæ, without any cellular changes. The muscularis propria may be lightly and diffusely infiltrated with lymphocytes and fibrous connective tissue. The serosa is usually not involved. In more advanced cases there is greater cellular activity and fibrous connective tissue replacement. Certainly in inflammation anywhere in the body there is accompanying degeneration and necrosis of some of the affected area and it would appear that the same condition could exist in the duodenum with or without the definite formation of an ulcer. In the more chronic forms there are numerous large germinal centres in all layers, including the serosa. This is also seen in sections of duodenal ulcers. The muscularis is usually not cocked as it is in the ulcer; in the ulcer the cocked appearance is due to loss of tissue balance which results in blending of muscularis with muscularis mucosæ and the submucosa, and occasionally it is an artifact due to the fixation. In all types and conditions of duodenitis there is distinct hyperplasia of Brunner's glands with a variable amount of intervening fibrosis in the more chronic and healed types. Cellular changes have not been noted in Brunner's glands and their hyperplasia may be compensatory in an attempt at neutralization or the performance of some other function in the duodenal contents.

In the true ulcer there are tissue reactions similar to those present in duodenitis. There is much glandular activity evidenced by the presence of numerous regenerative cells and mitotic figures. Neither in duodenitis nor in ulcer have I observed the cellular changes known as secondary cytoplasia which MacCarty¹⁰ described as occurring in certain gastric ulcers. In the mucosa are polymorphonuclear leucocytes, lymphocytes, plasma cells, and eosinophiles. These cellular changes are also found in sections taken from the immediate neighborhood of the ulcer. On gross examination, the newly excised lesion appears inflammatory with or without ulceration. This has been frequently noted by Judd.⁴ In one section the inflammatory changes were greater on the serosal side, suggesting that the process began as periduodenitis.

The thickness of the walls of the blood-vessels varies in both duodenitis and ulcer, increasing with the chronicity, particularly in the ulcers. In many instances the vessels in the submucosa, crater, and serosa are completely or partially obliterated. Lymphocytic infiltration is present in the media and adventitia, with proliferation of the intima. This proliferation of the intima causes thrombosis with resulting organization and canalization. These vascular changes may be a part of the inflammatory reaction in the tissue and



FIG. 5.—Chronic duodenal ulcer (x 6)

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probably play a part in the chronicity of ulcers. The changes in many respects simulate those described in thrombo-angiitis obliterans.¹ Fibrosis of the myelin sheaths of the nerves has also been noted.

SUMMARY

Some cases which are diagnosed duodenal ulcer, at operation, show an area of localized thickening of the duodenal wall instead of a definite ulcer. This thickened area is designated duodenitis, which is described as occurring in various forms, as simple duodenitis, duodenitis with erosion or ulceration, chronic duodenitis and healed ulcerated duodenitis. In the more acute conditions there are lymphocytes, polymorphonuclear leucocytes, plasma cells and a few eosinophiles with congestion of the capillaries in the mucosa. In more advanced chronic conditions this inflammatory reaction manifests itself by distinct hyperplasia of Brunner's glands with infiltration of scattered lymphocytes and collections of lymphocytes throughout. The muscularis propria also contains some fibrous connective tissue. The blood-vessels are sclerosed, the sclerosis increasing with the chronicity of the condition. Similar changes occur in the process of development of an ulcer, suggesting a definite relationship between duodenitis and duodenal ulcer.

BIBLIOGRAPHY

- ¹ Brown, G. E., Allen, E. V., and Mahorner, H. R.: Thrombo-angiitis Obliterans, Philadelphia, Saunders, p. 200, 1928.
- ² Cruveilhier: Quoted by Hauser.
- ³ Hauser, G.: Ueber die Beziehungen der chronischen Gastritis und Duodenitis zum chronischen Magen-und Duodenalgeschwürs. Med. Klin., vol. xxiii, p. 120, January, 1927.
- ⁴ Judd, E. S., and Nagel, G. W.: Duodenitis. ANNALS OF SURGERY, vol. lxxxv, pp. 380-390, March, 1927.
- ⁵ Kirklin, B. R.: A Roentgenologic Consideration of Duodenitis. Radiology, vol. xii, pp. 377-381, May, 1929.
- ⁶ Konjetzny, G. E.: Entzündliche Genese des Magen-Duodenalgeschwürs ein Beitrag zur Kenntnis der Aetiologie Pathogenese und Therapie des Magen-Duodenalgeschwürs. Arch. f. Verdauungskr., vol. xxxvi, pp. 189-226, 1925.
- ⁷ Konjetzny, G. E., and Puhl-Kiel: Über die Bedeutung der Gastritis und Duodenitis für die Pathogenese des Magenduodenalgeschwürs. Deutsch. Path. Gesell., vol. xx, pp. 165-172, 1925.
- ⁸ Konjetzny, G. E., and Puhl, H.: Über die Bedeutung der Gastritis und Duodenitis für die Entstehung des Magen-und Duodenalgeschwürs. Med. Klin., vol. xxiii, p. 986, 1927.
- ⁹ Levine, S.: Etiology and Pathology of Peptic Ulcer. Am. Jour. Med. Sc., vol. clxxii, pp. 22-45, 1926.
- ¹⁰ MacCarty, W. C.: The Histogenesis of Cancer of the Stomach. Am. Jour. Med. Sc., vol. cxlix, pp. 469-476, April, 1915.
- ¹¹ MacCarty, W. C.: Excised Duodenal Ulcers: A Report of Four Hundred and Twenty-five Specimens. Jour. Am. Med. Assn., vol. lxxxiii, pp. 1894-1896, December 13, 1924.
- ¹² Mann, F. C.: Production and Healing of Peptic Ulcer. Minn. Med., vol. viii, pp. 638-640, October, 1925.

DUODENITIS AND DUODENAL ULCER

- ¹³ Mayo, W. J.: Pathological Data Obtained from Ulcers Excised from the Anterior Wall of the Duodenum. *ANNALS OF SURGERY*, vol. Ivii, pp. 691-694, 1913.
- ¹⁴ Nickel, A. C.: Experimental Duodenitis, Duodenal Ulcer and Gastric Ulcer: Production of Lesions with Streptococci Obtained from Surgically Resected Ulcer-bearing Tissue and from Other Foci of Infection. (Unpublished.)
- ¹⁵ Ramond, F., and Darquier: Les duodénites considérées au point de vue étiologique et anatomo-pathologique. *Bull. et mém. Soc. méd. d. hôp. de Par.*, vol. xlix, pp. 1285-1288, July, 1925.
- ¹⁶ Rivers, A. B.: Hemorrhagic Focal Gastroduodenal Lesions; Preliminary Report of Three Cases. *Arch. Int. Med.*, vol. xxxix, pp. 564-570, April, 1927.
- ¹⁷ Rosenow, E. C.: The Causation of Gastric and Duodenal Ulcer by Streptococci. *Jour. Infect. Dis.*, vol. xix, p. 333, 1916.
- ¹⁸ Virchow: Quoted by Hauser.
- ¹⁹ Wellbrock, W. L. A.: Early Gastric Cancer. *Arch. Path.*, vol. viii, pp. 735-743, November, 1929.

PRIMARY SOLITARY DIVERTICULITIS OF CÆCUM

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THE subject of diverticulitis was first given prominence by Grasser in 1898, at which time it was known as "Grasser's Tumor." The cases studied by him and by Beer, Fisher, Mayo, and others, involved almost exclusively the sigmoid colon; so that even today "diverticulitis", to the average surgeon, means inflammation in the multiple, acquired or "false" diverticula of the sigmoid.

Telling, in 1908, correlated all the existent knowledge on diverticulitis and classified diverticula as either:

1. Congenital, or "true"—such as Meckel's Diverticulum. (All three coats present.)
2. Acquired, or "false"—such as occurs in the typical case of Sigmoid Diverticulitis. (Only serosa and mucosa present—muscularis absent.)

Telling considered these "false" diverticula as simple hernial protrusions of mucosa, submucosa and serosa (note the absence of the muscular layer) through some weakened area of the bowel wall. Klebbs associated these "weakened areas" with the blood-vessels perforating the circular muscle fibres of the bowel wall and Drummond felt that such blood-vessels predisposed to diverticula just as the spermatic cord predisposes to an inguinal hernia. Other predisposing causes universally acknowledged are obesity, constipation, and increased intra-intestinal pressure from whatever cause.

Drummond insists that all diverticula are "false" (*i.e.*, acquired) and always multiple, with the singular exception of a Meckel's diverticulum. In a recent article on diverticulitis of the cæcum, Greensfelder and Hiller likewise insisted that all such diverticula are "false," whether they occur as a primary condition (due to predisposing causes mentioned above) or whether they occur secondarily to trauma, as in a previous appendectomy; they reported four cases of secondary or post-traumatic solitary diverticula of the cæcum.

Other authorities likewise are insistent that all diverticula (save a Meckel's) are acquired or "false" and represent simple hernial protrusions. I, therefore, wish to report a case I recently operated upon; first, because it is very rare, being a case of inflammation in a solitary diverticulum of the cæcum; but also because histological examination of the removed solitary diverticulum demonstrated the presence of circular muscle fibres in part of its wall, a fact which at least suggests the possibility of its congenital origin. A careful review of the literature reveals only one similar case where circular

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muscle fibres were present.⁷ In this case, reported by Pereira, all three coats were completely present. I am unable to explain, on an embryological basis, the occurrence of a possibly congenital diverticulum of the cæcum, unless it be true as was recently suggested by Greensfelder and Hiller that such primary solitary cæcal diverticulae may be due to "the retention in some residual form of the appendix which appears early in embryological life but normally disappears before the true appendix develops."⁴

The report of my case follows: Mrs. M. R., sixty-three years of age, white, record No. 31647, was admitted August 7, 1928, on account of pain in right lower quadrant of abdomen, and discharged August 22, 1928. Her family history was negative. Personally, she had suffered from chronic interstitial nephritis, arterio-sclerosis, and hypertension for several years past, and arthritis deformans, involving principally both knees, for past two years. Menopause ten years ago.

The present illness arose suddenly with localized pain over McBurney's point; no preceding generalized abdominal pain. Then followed nausea, but no vomiting. Her fever was 99° F.; this was her first attack.

Physical examination was essentially negative except for abdomen which was tender over McBurney's point and with only a slight amount of localized rigidity present. The pre-operative diagnosis was acute appendicitis, for which operation was done. The appendix was found normal. An inflamed, solitary diverticulum was found adherent to the anterior wall of the cæcum. After separation from surrounding adhesions it was found that the diverticulum arose from the antero-lateral wall of the cæcum, about two inches above the ileocæcal valve. It was about one and a half inches long, tense and congested and contained a large coprolith. The diverticulum was removed and the stump inverted with purse-string. The normal appendix was likewise removed. Uneventful convalescence.

Laboratory findings.—Urinalysis—negative. Wassermann blood count 9500—(pre-operative).

Pathological specimen report.—1. Normal appendix. 2. Inflamed diverticulum of intestine. This diverticulum is lined throughout with mucosa and contains numerous Lieberkühn glands. The muscularis mucosæ is everywhere present. Surrounding this are a few solitary lymph follicles and fatty tissue. A large patch of circular muscle fibres is also present although it does not completely surround the diverticulum in this particular cross-section. The serosa completely covers the whole diverticulum and all of the layers are moderately infiltrated with lymphocytes, plasma cells, and eosinophilic leucocytes.

Table I shows a tabulation of the essential features in all cases of primary solitary cæcal diverticulitis reported to date, including the above case—eight cases in all. The post-traumatic cases of solitary cæcal diverticulitis reported by Greensfelder and Hiller, Bunts and others, are secondary (not primary) and, hence, not included in this table.

SUMMARY

A rare case of primary solitary diverticulitis of the cæcum is reported. Rarer still, histological examination demonstrated the presence of a mass of circular muscle fibres in its wall, a condition which would seem to suggest the possibility of its congenital origin, and the theory that, if congenital, it represents a rudimentary appendix is considered plausible. It would seem

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TABLE I

Reported by	Sex	Age	Initial symptom	Subsequent symptoms	Palpable mass	Other physical signs	Size of diverticulum	Copro-lith	Operative procedure	Outcome	Previous history	Pre-op. diagnosis	Microscopic examination of diverticulum
Jackson, 1917	F.	23	Pain in R. L. Q.	Fever, nausea, vomiting	Present	Tenderness, rigidity	2½ x 3 in. on aspect of cæcum	Present	Partial resection of cæcum	Recovery	.....	Acute appendicitis	Not noted
Pereira, 1917	F.	54	Vomiting	Pain in R. L. Q., slight fever	Present	Tenderness, rigidity	½ in. long, 1 in. from surface of appendix	Present	Excision of cæcum and of part of ilium	Recovery	.....	Acute appendicitis	All three coats present
Moschowitz, 1918	M.	44	Pain in R. L. Q.	None	Present	Tenderness, localized rigidity	1 in. long	Present	Excision of diverticulum	Post-op. pneumonia, then recovery	.....	Acute appendicitis	"False diverticulum"
Cooke, 1922	M.	53	Lower abdominal pain	Fever	Present	Tenderness, rigidity	1 in. long	Present, 2 cm. in diameter	Total excision of cæcum	Recovery	Always constipated	Acute appendicitis	Not noted
French, 1923	F.	29	Nausea	Loss of weight	None	Slight tenderness	¾ in. in diameter	Present, "very hard,"	Dislodged, carbolith and diverticulum inverted and buried	Recovery	Numerous similar previous attacks	Chronic appendicitis	Not done
French, 1923	F.	62	Pain in R. L. Q.	Vomiting, fever	None	Tenderness, rigidity	Not noted	Present, size of a grape	Excision of cæcum	Recovery	.....	Acute appendicitis	Not noted
Potier, 1912	F.	32	Abdominal pain	Vomiting, diarrhoea	Present	Rigidity	Not stated	None	Diverticulectomy, appendectomy	Recovery	.....	Acute appendicitis	Not noted
Leonardo, 1929	F.	63	Pain in R. L. Q.	Nausea, slight fever	None	Tenderness, slight rigidity	1½ in. long, 2 in. above valve, on antero-lateral surface of cæcum	Present	Diverticulectomy, appendectomy	Recovery	Acute appendicitis	Circular muscle fibres present

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that the standard classification of diverticulae as being "false" or acquired, except a Meckel's, may not be entirely true.

BIBLIOGRAPHY

- ¹ Cooke, A. B.: When Appendicitis Is not Appendicitis; a Case of Diverticulitis of Cæcum. J. A. M. A., vol. xxviii, p. 578, 1922.
- ² Drummond, H.: Sacculi of the Large Intestine, with Special Reference to Their Relations to the Blood Vessels of the Bowel Wall. Brit. Jour. Surg., vol. iv, p. 407, 1917.
- ³ French, R. W.: Diverticulitis of the Cæcum with Report of Three Cases. Boston Med. and Surg. Jour., vol. xxxix, p. 307, 1923.
- ⁴ Greensfelder, L. A., and Hiller, R. I.: Cæcal Diverticulosis, with Special Reference to Traumatic Diverticula. Surg. Gyn. and Obs., vol. vi, p. 786, 1929.
- ⁵ Jackson, W. R.: Diverticulitis of the Cæcum. New York Med. Jour., vol. vi, p. 83A, 1917.
- ⁶ Moschowitz, A. V.: Acute Gangrenous Perforated Diverticulitis of Cæcum. ANNALS OF SURGERY, vol. xii, p. 624, 1918.
- ⁷ Pereira, H.: Diverticuli of Cæcum. Brit. Med. Jour., vol. i, p. 279, 1927.
- ⁸ Potier, F.: Diverticulé et appendicite. Bull. et Mém. Soc. Anat. de Par., vol. xxxvii, p. 29, 1912.
- ⁹ Telling, W. H. M., and Gruner, O. C.: Acquired Diverticula, Diverticulitis, and Peridiverticulitis of Large Intestine. Brit. Jour. Surg., vol. iv, p. 468, 1917.

THE INTRA-ABDOMINAL POST-OPERATIVE COMPLICATIONS OF APPENDICITIS*

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THE intra-abdominal complications of appendicitis usually follow acute inflammatory lesions of the appendix, and are prone to occur in those cases in which the infection has extended beyond the appendix. Although any extension of the infection beyond the appendix is a complication, it will be

TABLE I
APPENDICITIS ON ADMISSION

Compilation of cases of appendicitis showing incidence of abscess and peritonitis upon admission to the hospital

Author	Total Cases	Chronic	Acute	Abscess	Abscess Per Cent.	Peritonitis	Peritonitis Percentage	Number Extending Beyond Append.	Percent-age
Guerry	2,959	1,607	1,352	517	42	85	6.3	602	48.3
Dudley						48 Diffuse	8.6		
Schaer	2,591	826	1,765	165	9 of acute	238 Beginning	13 Acute	475	26
Stillman	1,748	833	915	258	28	72 Diffuse	46 Acute		
						110 Local	12	411	45
						43 Diffuse	7.9		
Quain and Waldschmidt			1,000	289	29	160	16	449	44.9
Bancroft			534	133	23	73	12	206	35
Clairmont and Meyer	1,594	415	1,179	62	5.2	172 Perforated Appendix	14.6	315	26.6
Cutler ¹			974	290	29	81 Peritonitis	6.9		
						102 General Peritonitis	10	392	39
Gatch and Durma ¹			262					202 "Pus Cases"	78.2
Beekman ²			145					87	66
Maes			88 (Over 40 years)	53	36.4	44	30.4	40	46
Lett	1,000	363	637	431	67	18 Ruptured			
						22 Gangrenous			
						40 Local	6.2	631	100
Charity Hospital Cases	1,000	302	698	211	30	166 General			
			193	57	29.5	401 Local			
						80 General			
						23 Diffuse			
						72 (122)	11.9	152	78.7
							37.3		

¹ Cutler had 392 cases (40 per cent. in which the appendicitis was "Suppurative", requiring drainage.

² Beekman's series comprised only children. In all cases under six years of age the appendix was perforated.

³ These cases showed sufficient evidence of peritoneal involvement to require drainage.

the purpose in this discussion to consider the post-operative complications. The incidence of complications following appendicitis depends upon the extent of the infection at the time the patient is seen by the surgeon. It varies with (1) the age of the patient, (2) the care received previously and the treatment instituted by the surgeon, (3) the virulence of the offending organism, and (4) the resistance of the patient. The extension of the process beyond the

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appendix depends largely upon the care which the patient has received before being brought to the surgeon (especially as regards the administration of cathartics) and the length of time which has elapsed since the onset of symptoms. The extent of the infection at the time the patient consults the surgeon varies in different clinics (Table I). In from 26 per cent. to 100 per cent. of cases of acute appendicitis the infection has extended beyond the appendix at the time of the patient's admission to the hospital. Of 193 consecutive cases of acute appendicitis admitted to the Charity Hospital in New Orleans during a period of 22 months, 67 (29.5 per cent.) presented a localized abscess, 23 (11.9 per cent.) a diffuse peritonitis, and 72 (37.3 per cent.) sufficient evidence of peritoneal involvement to require drainage.

TABLE II
PERITONITIS

Compilation of cases of peritonitis occurring post-operatively in appendicitis, demonstrating the percentage of deaths in appendicitis as the result of peritonitis

Author	Cases Acute Appendicitis	Deaths	Mortality Percentage	Localized Peritonitis	Per Cent. of Mortality	Diffuse Peritonitis	Per Cent. of Mortality
Garlock.....	755	47	6	5	10.6	33	70.2
Beekman.....	145	11	7.6			8	73
Schaer ¹	1,290	73	5.7			32	43
Gatch and Durman.....	262	19	7			11	56
Truesdale.....	259	10	3.8			4	40
Cutler ²	974	41	4			31	75
Clairmont and Meyer.....	1,594	49	3			38	77.5
Stillman.....	865	46	5.4			3	6.5
Charity Hospital Series.....	193	39	20.21			23	58

¹ Schaer—of 9 deaths occurring in acute appendicitis, non-perforated, of 13 in appendiceal abscess, of 10 in beginning peritonitis, and of 41 in diffuse peritonitis, the death was due to peritonitis in 2, 5, 4, and 21 instances respectively.

² Three hundred and ninety-two cases were of the suppurative type requiring drainage. Peritonitis represented 63 per cent. of all complications.

One must agree with Deaver that severe acute appendicitis always causes a certain degree of peritonitis. It is, however, essential to differentiate, as well as possible, between those types of peritonitis in which the peritoneum of the appendix alone is involved and those in which the infection has extended beyond this viscus. Of the various intra-abdominal complications following appendectomy, the most important, when considering the probable mortality, is diffuse peritonitis. It is rather difficult, from a study of the literature, to determine the incidence of general peritonitis as a post-operative complication, but fortunately this complication is relatively rare. It is, however, responsible for the greatest number of deaths in acute appendicitis (Table II). As a cause of death in appendicitis peritonitis varies from 6.5 per cent. to 77.5 per cent. That a diffuse peritonitis, occurring as a post-operative complication in acute appendicitis, may be the result of improper surgical treatment must not be forgotten. The proper use of the conservative therapy, as outlined by the late Dr. A. J. Ochsner, in selected cases of acute

appendicitis will not only decrease the incidence of diffuse peritonitis as a post-operative complication but will also lower the mortality in these cases.

Guerry, in a series of 123 cases of acute diffuse peritonitis, in which operation was deferred, had a mortality of 1.6 per cent. In another group of acute diffuse peritonitis, which were operated upon immediately, there were 7 deaths (8.2 per cent. mortality). Guerry states, "I am more firmly established today than ever before in the belief that the secret of the mortality lies in the deferred operation as applicable to this particular group of cases." Deaver and Magoun, in a review of 4,588 appendectomies, believe that a decrease in the mortality rate from 10.5 per cent. for the years 1901 to 1905, inclusive, to 4.2 per cent. for the years 1915 to 1919, inclusive, was due to the institution of "conservative treatment" in the proper cases. It is not within the realms of this paper to discuss the operative or pre-operative care of cases of appendicitis. The "conservative treatment," however, is mentioned because of its importance in preventing certain post-operative complications. We wish merely to emphasize, in passing, that the "conservative treatment" is not a medical treatment, but is surgical in every sense of the word. It is one which is extremely difficult to employ properly and one which requires a great deal more surgical judgment than the so-called "radical therapy." It is our opinion that for the "occasional operator," one who does not frequently treat patients with peritonitis and varying types of appendicitis, it is probably better to remove the appendix when the patient is first seen. On the other hand, lives will be lost by this procedure which could have been saved by the proper institution of the conservative therapy by an experienced surgeon. Jopson and Pfeiffer believe that the treatment of appendicitis in children, of cases of delayed or fulminating gangrene and of cases in which intra-abdominal rupture of a localized abscess has occurred, should not be conservative.

The diagnosis of general peritonitis is easy. The patient does not recover well from the operation. The pain which was present before operation still persists, is diffuse in character, and is more or less dull in nature. Vomiting is almost invariably present. The abdomen is distended, tympanitic, and there is tenderness and rigidity over the entire abdomen. The pulse rate is increased and the temperature is elevated, often to a very high degree. As a result of the hyperpyrexia, the inability to take fluids, and the loss of fluids by vomiting, dehydration rapidly ensues. If untreated, the condition progresses, causing the death of the individual. This may also occur in spite of active therapy.

The treatment of peritonitis consists of conservatism. The patient is placed in the Fowler's position, so that any peritoneal exudate may gravitate into the cul-de-sac. Heat is applied to the abdomen in the form of an electric light tent or hot compresses. Nothing is given by mouth, not even water. Fluids, either normal saline or glucose solution must, therefore, be administered by proctoclysis, hypodermoclysis, or intravenous infusion. The demand for fluids is abnormally great, because of the increased metabolism attendant upon the hyperpyrexia and because of the constant loss of fluids by vomiting. The administration of 4 to 5 litres of fluid every twenty-four hours is ex-

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tremely important, and should be instituted early and consistently continued. In prevention of severe dehydration this point cannot be overemphasized. If the patient vomits, repeated gastric lavage, employing large amounts of warm water, is indicated. Under certain conditions, the introduction of a duodenal tube is permissible. The total abstinence from food should be adhered to as long as there is any sign of peritoneal irritation.

Closely associated with, and usually the result of, peritonitis is ileus, which occurs as another post-operative complication of appendicitis. Fortunately, this complication is found less frequently than some of the other complications, but, because of its severity and its close association with peritonitis it should be considered with this condition. In all cases of peritonitis, especially the diffuse variety, a certain amount of ileus is present. In considering ileus in cases of appendicitis it is essential to differentiate between mechanical obstruction and the adynamic variety, the latter type being the one more frequently encountered, especially in the diffuse type of peritonitis. In the various statistical reports often no differentiation is made between these two types of ileus. It may be assumed, however, that all patients with a diffuse peritonitis have an adynamic ileus to a greater or lesser degree. It is considered by some that death in general peritonitis is not due to the toxemia from the peritonitis itself, but rather to the toxemia produced by the absorption of toxins from the paralytic, atonic bowel. It is obviously impossible to demonstrate the truth of such a statement, since two sources of toxemia are present, *i.e.*, the peritoneal cavity and the bowel. It is illogical to assume that one factor is more important than the other in absence of quantitative measurements (Table III). Ileus comprises from 6 per cent. to 15 per cent. of all post-operative complications of appendicitis.

Quain and Waldschmidt believe that the location of a gangrenous appendix in the mid-portion of the abdomen is especially dangerous, because of the danger of adhesions forming between the loops of bowel with a resulting obstruction. They advise an enterostomy at the time of the primary operation if there is a diffuse peritonitis.

Mann believes that if a purulent exudate is left in the pelvis at the time of operation a matting together of the intestines is apt to occur. This condition has been described previously by others. It has been shown by a number of observers that obstruction is very apt to occur in the region of the terminal ileum, especially in the cul-de-sac (Handley, Eisendrath).

Stillman had sequelæ develop in 124 cases (7 per cent. of all acute cases), all of which occurred post-operatively. The intra-abdominal complications numbered 47 (2.7 per cent.). There were 13 cases of acute ileus (7.8 per cent. of all the cases of sequelæ, 27.6 per cent. of the intra-abdominal complications). Of these 13 patients, 8 died (61.5 per cent. mortality). Of the 13 cases, 11 were operated upon and 1 was cured by enema, and in 1 case the diagnosis was established only at autopsy. The obstruction in the 12 cases which were re-operated upon was always in the small gut and was due to adhesions or angulation. In 8 the obstruction was close to the ileo-cecal valve; enterostomy was performed in 2 cases, enterorrhaphy in 2 cases, and aspiration of bowel to relieve pressure in 1 case.

The etiology in all cases is an antecedent or existing infection, the peritonitis being, almost invariably, the cause of the obstruction, both in the mechanical and the adynamic types. The incidence of this complication would

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TABLE III—ILEUS
Compilation of cases of acute appendicitis demonstrating the number of cases of ileus complicating this condition, as well as the percentage of deaths

Author	Acute Appendicitis	Deaths	Per Cent. of Deaths	No. of Complications	Mechanical Obstr.	Adynamic Ileus	No. of Complications	Combined Obstr.	No. of Complications	Per Cent. of Deaths
Gatch and Burman	262 (205 "Pus Cases")	19	7	32				2	15	10
Bancroft	384	25	4.2					5 ¹		29
Dudley ²	560	26	4.6					12		48
Schaefer ³	1,400	72	5.58					2		2.7
Quain and Waldschmidt	1,000	27	2.7					7		20
Stillman	865	46	5.3	{ 124 47 Intra-Ab.				13 ⁴	{ 7.8 All (27.6 Intra-Ab.)	
Cutler ⁵	974	41	4.8	83				5	6	
Leit	608	30	4.8	83				12	14	
Deaver				14				2	2	
Ruge				27				14	14	
Clairmont and Meyer	2,385	155	6.7					44		
	1,179							7	4.5	

¹ Four of these patients died (mortality 80 per cent.)

² In these cases there were 48 cases of diffuse peritonitis at time of operation. Of this group 25 per cent. developed an adynamic ileus subsequently.

³ No evidence of mechanical obstruction in cases with appendical abscess or diffuse peritonitis. Probably in these cases adynamic ileus is partially responsible for the death.
⁴ Ileus occurred only after drainage.
⁵ Three hundred and ninety-two were suppurating.

TABLE IV—RESIDUAL ABSCESES
Compilation of cases of acute appendicitis showing incidence of complications, with special reference to the number and type of residual abscesses

Author	Acute Appendicitis	Complications	Per Cent. of Cases	Intra-Abdom. Complications	Per Cent. of All Complications	Number of Residual Abscesses	Per Cent. of Cases	Per Cent. of Intra-Abdom. Cases	Rt.-Sided	Per Cent.	Sub-Phrenic	Per Cent.	Left-Sided	Per Cent.
Stillman	545	124	38	24	4.4	12.5	19	1.2	50	4	16	9	37	2
Bancroft	544	71	12.3	45	4	38	84		10	55	6	33	2	11
Cutler	974 (92 Suppurative)	83	8.5	59	18	21	100							
	145	23	15	65	15	65		305		3	20	10	6.6	8
	1,179 ²	719	60	162	23	79	5.7	11	48	62	8	10	7 (3 Sub-Spects)	11
Beekman								39 (67 Infiltration ³)	23					
Clairmont and Meyer									54	11	26	39	7.3	8
Suermondt	630 ⁴	250												19
Wolf														
Truesdale	250													

¹ Secondary abscess in 1.6 of the non-drained and 6.2 per cent. of the drained cases.
² Only 8.8 per cent. were drained at the primary operation.

³ 4.2 per cent. of all the acute cases of appendicitis had cul-de-sac involvement.
⁴ 36 per cent. were drained at the primary operation.

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depend largely upon the length of time elapsing between the onset of symptoms and operation. Those cases in which the infectious process has spread beyond the appendix are more prone to develop this complication, because a peritonitis develops more frequently. The symptoms and signs of ileus are quite definite. The patient, in addition to exhibiting signs of peritonitis, as described above, is unable to pass flatus or stool. Vomiting, due to reverse peristalsis, is frequent. The vomitus, which at first contains gastric contents, later may become stercoraceous. Abdominal distention, at first not marked, later becomes a very prominent sign. Due to the elevation of the diaphragm an embarrassment of the respiratory and circulatory systems results. The abdomen, in addition to being distended, is abnormally tympanitic. Even though the diagnosis of ileus is not difficult, and, as has been said previously, every case of diffuse peritonitis is associated with a certain degree of ileus, it is often extremely difficult to differentiate between the mechanical and adynamic varieties. As a rule, the pain in the two types of ileus differs. In the mechanical variety the pain is characteristically colicky and intermittent; associated with this pain, and also the cause of it, there is increase in peristalsis in the gut proximal to the obstruction. This can often be seen and can always be heard. In the adynamic variety of ileus, on the other hand, pain is characteristically absent. Auscultation of the abdomen is of great value in a negative sense, because in adynamic ileus no sounds are audible. It must be kept in mind that an adynamic ileus may be superimposed upon and may follow a mechanical ileus. In fact, all cases of mechanical ileus which are not relieved are usually followed by the adynamic variety. In cases of suspected ileus a röntgenogram of the abdomen taken with the patient in an upright position without the introduction of contrast media is of distinct value in making a diagnosis. In ileus a typical picture is obtained. Due to the presence of large amounts of gas and fluid in the various loops of bowel, numerous fluid levels can be seen scattered throughout the abdomen. This finding is pathognomonic of intestinal obstruction.

Treatment.—The treatment of ileus developing post-operatively or following acute appendicitis is the same as that employed in ileus due to any other causes. The prime requisite in treatment is early diagnosis, so that the proper therapy might be instituted before a profound toxemia has occurred.

Haden and Orr have shown that associated with the toxemia in intestinal obstruction there are certain very definite and constant changes in the blood. These are: hypochloremia, an increase of the carbon dioxide combining power of the plasma, and an increase in the non-protein nitrogen of the blood. Because of these very constant findings, it is desirable in all cases of ileus to determine the amount of blood chlorides, the CO₂ content of the plasma, and also the amount of non-protein nitrogen in the blood. In cases in which there is a decrease in the amount of blood chlorides, chlorides should be administered either subcutaneously or intravenously. As these patients are usually dehydrated, the administration of sodium chloride intravenously, either in a

normal or 1 per cent. solution, is of distinct value. Saline should be administered pre-operatively. The existing alkalosis is relieved by the replacement of the blood chlorides.

The operative procedure in cases of mechanical ileus consists of re-laparotomizing the individual as soon as possible. In those cases in which the obstruction is due to the presence of bands of adhesions these are divided. This is often a simple procedure. If, however, there is evidence of disturbance in the circulation of the bowel, it is often necessary to resect portions of the gut. An enterostomy performed during the original operation was first executed by Heidenhain. This procedure has won considerable favor recently in those cases of peritonitis associated with adynamic ileus. Often the introduction of an enterostomy tube into dilated, atonic gut is of little value, as the tube drains only that small portion of the intestine in the immediate vicinity. Certain cases of adynamic ileus may be successfully treated by blocking the splanchnic nerves either by introducing an anaesthetic solution intraspinally or in the region of the splanchnics. The latter procedure has been performed by Ochsner, Gage, and Cutting in a large series of experimental animals, and also in clinical cases, with very satisfactory results. As a post-operative measure in all cases of ileus the administration of saline solution is imperative. Most authors believe that if an ileostomy is to be performed it should be done early. Dudley even advocates the suturing of the jejunum to the parietal peritoneum and the introducing of a large tube directly into the lumen of the gut rather than an enterostomy done according to the technic of Witzel.

Residual Abscess.—Intraperitoneal abscesses occurring post-operatively usually follow general peritonitis and in that sense are truly residual. In some instances, however, it is possible to have primary abscesses in parts of the peritoneal cavity other than the ileo-cecal region, where the usual "appendiceal" abscess is found. That residual abscesses are not only found in undrained cases is shown by Bancroft's series. He found secondary intra-abdominal abscesses in 1.6 per cent. of the non-drained cases of appendicitis and in 6.2 per cent. of the drained cases. Of the reported cases residual abscess occurred in from 1.8 per cent. to 5.7 per cent. of all cases of acute appendicitis (Table IV).

In addition to the usual type of secondary intra-abdominal abscess, Martin and Melchior have reported cases of late abscesses occurring intra-abdominally months and even years after the primary infection.

It is evident from statistics that the incidence of secondary abscesses occurring within the abdomen following acute appendicitis varies considerably, and, as Seurmondt's and Bancroft's series show, drainage of the peritoneal cavity does not seem to prevent the formation of this complication. There are certain definite sites at which these localized inflammatory lesions are more apt to occur. Localized inflammation occurs at these sites much more frequently than is commonly appreciated. The most frequent sites at which these inflammatory processes, which may or may not progress to abscess

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formation, are apt to occur are: the cul-de-sac of Douglas, the ileo-cecal region, the subphrenic space, and the left iliac region (Fig. 1). In cases with secondary abscesses there are certain symptoms and signs which are common to all. The history in each is usually quite typical. A patient who has had acute appendicitis, in whom the appendix has or has not been removed, continues to have fever and to complain of abdominal pain. Associated with the elevation of temperature there is a leucocytosis. As a rule tenderness in the region of the localized infection can be elicited, if the localized infection can be approached by means of the examining finger. If the case is allowed to progress, the temperature curve assumes a hectic type. In addition to these general symptoms and signs, there are usually localized symptoms and signs which vary according to the site of the inflammatory process. These will be discussed under separate headings.

Abscess of the Cul-de-sac of Douglas.—In considering infections of the cul-de-sac it is essential to differentiate between simple infection of the peritoneal pouch, infiltration, and suppuration. At the present time the generally accepted treatment of acute appendicitis, especially those cases in

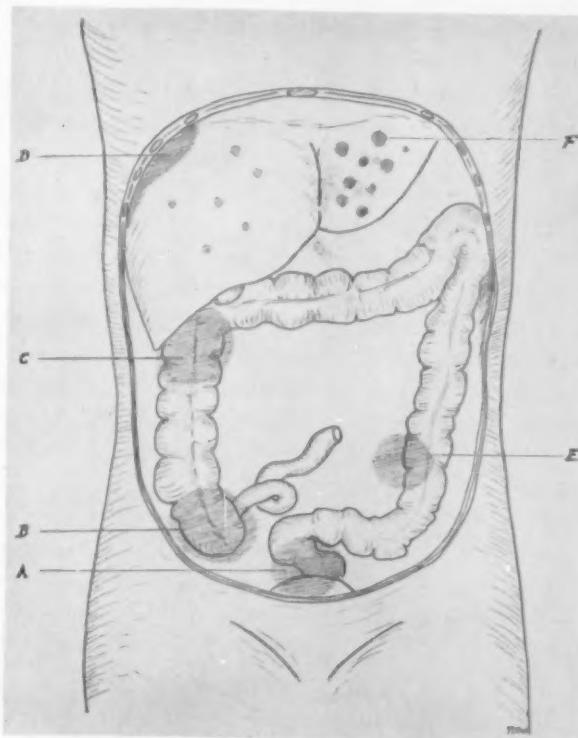


FIG. 1.—Diagrammatic drawing showing the various sites of localized suppurative processes within the abdomen following appendicitis. A—Cul-de-sac of Douglas infection; B—Ileo-caecal infection; C—Sub-hepatic infection; D—Supra-hepatic infection; E—Left-sided infection; F—Liver abscess, the result of pylephlebitis.

which the infection has extended beyond the appendix itself, consists of placing the patient either in Fowler's position or some modification of it. This is done for several reasons. Fowler believed that absorption was less from the pelvic peritoneum than the diaphragmatic peritoneum. Whether or not absorption is less from the pelvic peritoneum is still an open question. In all probability more toxic material is absorbed from the diaphragmatic peritoneum not because of the difference in the character of the peritoneum itself, but because of the constant massaging of the diaphragmatic peritoneum as the result of respiratory movement. Another equally, if not more, important reason for attempting to favor drainage into the cul-de-sac of Douglas is

that if a secondary inflammatory process or abscess results, it is in a position which is surgically more accessible than in some other parts of the abdomen. With the patient in the extreme Fowler's position the cul-de-sac of Douglas is the most dependent portion of the peritoneal cavity, and in cases of peritonitis there is a tendency for fluid and exudate to gravitate into this pouch. Pathologically three types of cul-de-sac infection must be differentiated: (1) those in which the pouch is filled with inflammatory exudate which has gravitated to the pelvis from other parts of the peritoneal cavity, producing local peritonitis; (2) those in which the inflammatory process has become walled off from the rest of the peritoneal cavity; and (3) those in which suppuration has occurred.

Nather and Ochsner reported 62 cases of cul-de-sac infection among 700 cases of acute appendicitis observed in the Zürich Surgical Clinic. In 27 per cent. of the cases of acute appendicitis the peritoneal exudate present at the primary operation was found to be sterile. In another 46 per cent. there was either no bacteriological examination made or no exudate was present. Thirty-nine (5.6 per cent.) showed evidence of only Douglas infiltration, and responded to conservative therapy. Of the 39 cases with secondary abscesses in the cul-de-sac 25 had been closed at the primary operation without drainage. There were 14 cases in which at the time of the original operation the cul-de-sac was found to be filled with pus. In 3 of these drainage was instituted through either the vagina or rectum. All of these patients died. The remaining 11 cases were drained by means of rubber tube and gauze extending from the cul-de-sac out through the abdominal wound. In 3 of these patients so treated a Douglas abscess resulted, necessitating subsequent drainage. Thus, a definite abscess developed in 18.1 per cent. of those cases in which there was primary drainage of the peritoneal cavity and 27.2 per cent. of those in which there was primary drainage of the Douglas pouch.

Barnes has recently emphasized the importance of this complication, and makes a plea for its recognition at the time of original operation so that the subsequent development may be prevented.

Signs and Symptoms.—The general signs and symptoms have been discussed above. Because of its relative inaccessible location, a collection of fluid or an inflammatory process in the cul-de-sac of Douglas often, and usually, gives rise to no symptoms, unless there is an involvement of some of the surrounding viscera. For this reason, it is essential and imperative in all cases of acute appendicitis in which infection has spread beyond the appendix itself, and especially those in which the patient has been placed in Fowler's position, to examine the rectum post-operatively. As the inflammatory process will probably occur within the first week post-operatively, this examination should be performed at least every other day for a period of days. It is essential that both the rectum and bladder be empty. In those cases in which the Douglas pouch is filled with inflammatory exudate a bulging of the anterior rectal wall can be felt. As the infection progresses an

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induration, which appears as a hard, painful tumor, can be palpated. If suppuration occurs, a soft fluctuating area within the indurated mass becomes evident. In order to appreciate the changes occurring in a cul-de-sac infection, it is essential to examine these patients frequently. Due to the location of the inflammatory process, there is often an associated irritation or infection of the bladder and rectum. As the result of these changes, the patient complains of certain symptoms. Difficulty in defecation was observed in 50 per cent. of Nather and Ochsner's series. Diarrhea, with an increase in mucous secretion, was observed in 40.7 per cent. of their series, whereas severe constipation was present in 7.7 per cent. In addition to these rectal symptoms, the patient often complains of bladder symptoms, especially urgency, frequency, and a sense of pressure in the region of

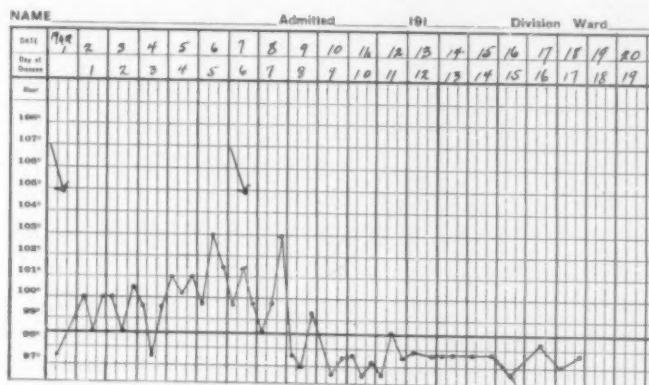


FIG. 2.—Temperature curve usually found in cases of cul-de-sac infection. The temperature immediately after the appendectomy, as indicated by first arrow, steadily rose until an abscess in the cul-de-sac of Douglas was drained, as indicated by the second arrow. Following this, the temperature fell.

the bladder. A very important diagnostic sign in these cases, especially in those in which suppuration is present, is a marked relaxation of the anal sphincter. This is due to a paresis of the rectal and anal musculature. The mucosa of the rectum becomes thickened, edematous, and succulent. The diagnosis of a Douglas infection is not difficult if the condition is considered, and any case of acute appendicitis which is not progressing satisfactorily should be examined rectally, in order to determine the presence of this complication. The rise in temperature caused by an abscess in the cul-de-sac of Douglas usually appears on the sixth or seventh day. Nather and Ochsner have described three types of temperature curves in cases of cul-de-sac abscess.

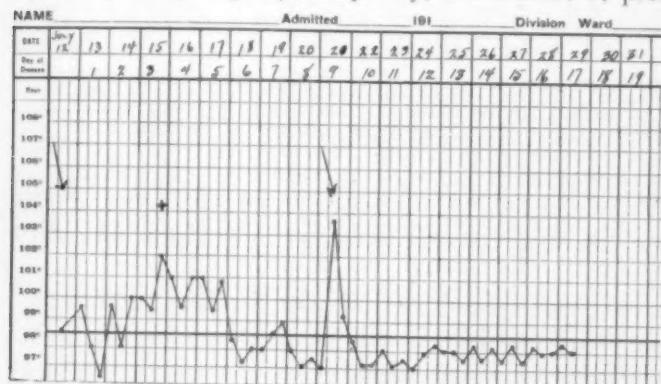


FIG. 3.—Second type of temperature curve found in Douglas abscess. The first arrow indicates the appendectomy. At the + an abdominal wall abscess was opened. Following this, the temperature fell to normal to rise abruptly on the tenth post-operative day, at which time, as indicated by the second arrow, an abscess in the cul-de-sac of Douglas was drained.

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Type 1 is that in which the temperature rises consistently after the appendectomy, until the opening of the Douglas abscess. They found that 54.1 per cent. of their cases were in this group. (Fig. 2.)

Type 2 is that in which the temperature falls to normal and, after seven or eight days, again rises until the abscess is relieved by drainage. Thirty-seven and one-half per cent. of the cases were in this group. (Fig. 3.)

Type 3 is that in which the temperature characteristically rises several days after the appendectomy, as the result of a subcutaneous abdominal infection. The temperature again falls to normal and remains low for 2 to 2½ weeks, and is followed by an increase in symptoms and a return of fever, which are the result of the cul-de-sac infection. 8.4 per cent. in the group. (Fig. 4.)

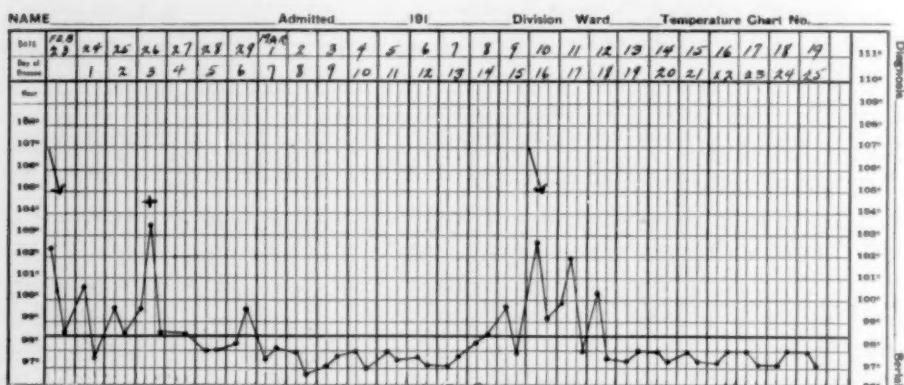


FIG. 4.—Third type of temperature curve as seen in cases of abscess of cul-de-sac of Douglas. The first arrow indicates the original operation. The + indicates the drainage of an abdominal wall abscess, following which the temperature fell to normal and remained so until the fifteenth post-operative day, when it rose suddenly again. The second arrow indicates the drainage of an abscess in the cul-de-sac.

If the process is allowed to progress, a definite abscess may form. Spontaneous resolution, however, may occur in those cases in which infiltration is present.

Treatment.—The treatment of cul-de-sac infection is, first, prophylaxis. The presence of fluid, either purulent or non-purulent in the cul-de-sac, predisposes to the development of a post-operative Douglas pouch infection. Barnes emphasizes the importance of recognizing such collections of fluid at the original operation, and advises aspirating the fluid by means of a soft rubber tube. It is essential to completely evacuate the pouch of the contained material at the time of the operation. After inflammation or infiltration has occurred in the cul-de-sac, the treatment is first conservative, as many cases subside spontaneously. The conservative treatment in this condition is the same as that advocated for peritonitis. In addition, it is desirable, whenever possible, to apply heat to the region of infection. For this Nather and Ochsner have advised a modification of the Arzberger cannula, by means of which heat may be applied, through the rectum to the infected area. Under

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such therapy the inflammatory process will either resolve or suppurate. As soon as suppuration has occurred, as evidenced by a softness and fluctuation in the centre of the indurated area, radical therapy is indicated. The operative therapy consists of drainage of the abscess through either the rectum or the vagina. Nather and Ochsner advise the routine drainage of these abscesses through the rectum, and in their 39 cases so treated had no untoward complications develop. The drainage of a cul-de-sac abscess through the vagina of the female, however, is permissible, but, because the condition may develop in males, it is probably advisable to have one routine technic by which these abscesses may be drained. The danger of infecting the peritoneal cavity by draining the abscess through the rectum is nil, as the abscesses are walled off from the peritoneal cavity.

The operation is best performed under local or sacral analgesia. It is seldom necessary to dilate the sphincter, because of the paralysis of the sphincter described above. A large aspirating needle is inserted in the fluctuating area, and as soon as pus is aspirated with the needle left *in situ* a longitudinal incision is made alongside the needle, opening the abscess. After the abscess has been incised, it is further opened, by means of forceps, and a large rubber tube inserted, which is brought out through the anus. The tube is secured in place by means of a T-bandage. As a post-operative measure the patient is given morphine in small doses over a period of two to three days, in order to prevent defecation. The drainage tube usually comes away with the first bowel movement, and it is practically never necessary to re-insert it. Within two to three days after the drainage of the abscess, the temperature becomes normal, and within eight to ten days all evidence of the inflammatory process subsides.

Ileo-cecal Abscess.—An infection in the ileo-cecal region is less apt to occur than in other parts of the peritoneal cavity, especially when drainage has been instituted at the time of the primary operation. Clairmont and Meyer report 8 para-cecal abscesses among 1,179 cases of acute appendicitis and 3 abscesses located partially on the right side, but which extended to the suprapubic region. Of 18 interaperitoneal abscesses reported by Cutler 10 (55 per cent.) occurred in the region of the cæcum. Here, as in the cul-de-sac of Douglas, the type of inflammation varies from simple infection to suppuration. The symptoms and signs are the same as those of all intra-abdominal abscesses. In addition, the patient complains of pain in the right lower quadrant of the abdomen in the region of the wound. Examination reveals tenderness and rigidity, which, however, often may be confused with wound tenderness. As an uncomplicated wound should not remain tender longer than one to two days, little difficulty should be encountered in making a correct diagnosis. Here too, as in the cul-de-sac infection, resolution may take place without the production of a suppuration. If, however, suppuration occurs, a definite mass, which is tender, is palpable in the right iliac fossa. Before suppuration occurs, it is impossible to tell whether the tumor is an

inflammatory exudate or abscess. This type of abscess offers very little difficulty as far as diagnosis is concerned.

The treatment of these cases is the same as that employed in peritonitis. It is essential, even in those cases in which the process is localized, to treat the patient as if he had a generalized peritonitis, *i.e.*, he should be given nothing by mouth, in order to avoid increasing peristalsis. In this way there is relatively little danger of the infection in being disseminated from its position in the right iliac fossa throughout the general peritoneal cavity. Heat should also be applied in the form of large, hot, moist dressings, which should be renewed every one to two hours. Occasionally it is advisable to alternate the moist dressings with dry heat in the form of an electric light tent. Most cases subside under this conservative therapy. If, under the conservative therapy, the fever continues, the mass in the right lower quadrant persists, and other signs and symptoms do not regress, operative interference is justified after one is certain that the process has become walled off completely. The operative procedure consists of incision and drainage, without opening the peritoneal cavity. Within a few days after the institution of drainage the abscess cavity becomes obliterated.

Left-sided Abscess.—A left-sided abscess is a relatively rare complication following acute appendicitis. Sprengel is of the opinion that a left-sided abscess may occur in either one of two ways. It may be associated with a cul-de-sac abscess and rise out of the pelvis. In case gravitation is prohibited into the pelvis by a blockage of the pelvic inlet, pus may pass to the left side and up along the sigmoid, and produce a localized inflammatory process. Nather and Ochsner, during a four-year period, in which 700 cases of acute appendicitis were observed in the Zürich Clinic, found 9 cases of left-sided abdominal abscess. Clairmont and Meyer reported from the same clinic, during a five-year period, 1,179 cases of acute appendicitis observed, among which there were 12 cases of left-sided abscess and 7 cases of left-sided infiltration. Moschowitz believes that in all cases in which there is an irritative exudate of the peritoneum it is possible to have a localization on the left side with the production of left-sided abscess. Schlange is of the opinion that all multiple abscesses in the peritoneal cavity follow a general peritonitis.

The possibility of a left-sided abscess complicating appendicitis in an individual with *situs inversus viscerum* must not be forgotten. Types of abscess occurring on the left side are (1) the usual form which is similar to typical right-sided appendiceal abscess, and is bounded below and laterally by Poupart's ligament and above and medially by the adherent loops of intestine; (2) the unusual type, which is located at a higher level, as a rule on a line connecting the two anterior superior spines. This type of an abscess is especially prone to occur in children. In 4 of the 9 cases reported by Nather and Ochsner the age was less than thirteen years. Royster states that two-thirds of the left-sided abscesses observed by him were in patients under twelve years of age.

The signs and symptoms are the same as those present in right-sided

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abscesses, except that the pain, tenderness, and rigidity are located on the left side instead of the right. The condition almost invariably occurs in those cases of appendicitis in which the process was not limited to the appendix at the time of the original operation.

The treatment consists of rest in bed and the application of heat to the abdomen, preferably in the form of large, moist dressings, alternating with the application of dry heat in the form of an electric light tent. In these cases also spontaneous resolution usually ensues. If, however, resolution does not occur and suppuration results, incision and drainage are indicated. The incision is made directly over the abscess and, whenever possible, the abscess should be opened without entering the free peritoneal cavity.

Subphrenic Abscess.—The occurrence of subphrenic infection in the course of acute appendicitis is not as rare as is commonly supposed or as one would surmise from the statistical reports. The incidence of subphrenic abscess varies from 6.6 per cent. to 73 per cent. of all residual abscesses (Table IV).

In order to understand the symptomatology and pathology of subphrenic abscess, it is necessary to have some knowledge of the anatomy of the subphrenic space. It is not within the realm of this paper to discuss the anatomy of this area in detail, as this has been done previously. Suffice it to say that the most frequent sites of localization for subphrenic infections following appendicitis are (1) the right posterior superior space, which is a relatively small area located above or posterior to the liver and posterior to the left lateral ligament, (2) the right inferior subphrenic space, which is located below the liver to the right of the round ligament and ductus venosus. It is not uncommon to have a supra-hepatic and an infra-hepatic infection occurring simultaneously. The anatomy of this region has been carefully studied by Martinez, Picuands, Barnard, Nather, and Ochsner.

Infection of the subphrenic space probably occurs in a number of different ways: (1) As has been emphasized by Eisendrath and others, the infection may extend upward along the paracolic groove to the right kidney pouch and thus invade the subphrenic region. This is probably the most frequent mode of infection.

(2) Munro has emphasized the possibility of a retro-peritoneal lymphangitis, causing infection of the subphrenic space;

(3) A subphrenic infection may be the result of a general peritonitis, the process remaining in the subphrenic space as a residual infection;

(4) The involvement of this space may follow multiple liver abscesses, which result from pylephlebitis;

(5) Another possibility is that the infection may extend upward retro-peritoneally as a phlegmon without passing through the medium of the lymphatics.

Ullman and Levy believe that those infections which occur as the result of a direct extension are located intra-peritoneally, whereas those which follow infections of the cellular tissues are retro-peritoneal and those which

extend by the lymphatic system may be either intra- or extra-peritoneal. As has been mentioned above, subphrenic infections are not infrequent; relatively few, however, suppurate. Neuhof states that most of the non-suppurative subphrenic infections are not diagnosed for two reasons: (1) because the infection is not fatal and cannot be determined at autopsy, and (2) because exploratory punctures are more frequently resorted to than exploratory incision. He reported 15 cases of non-suppurating subphrenic peritonitis complicating appendicitis which occurred among 972 cases of acute appendicitis (1.5 per cent.). In all cases there were typical signs of subphrenic infection. All patients recovered. Lee reported 4 cases of subdiaphragmatic infection which did not progress to abscess formation, all of which presented typical signs and symptoms of subphrenic infection, and in all, the symptoms subsided spontaneously. Clendening and Ochsner have called attention to the fact that subphrenic infections occur not infrequently and may subside spontaneously.

Symptoms and Signs.—The general symptoms of subphrenic infection do not differ from those of any localized infection within the abdomen. In addition to these, there may be relatively few other symptoms. In fact, the condition often is permitted to persist for weeks or months. Unfortunately, there are no early symptoms of subphrenic abscess. Here, as in cul-de-sac infections, it is essential to consider the condition in all cases of acute appendicitis which do not progress satisfactorily. In this way a diagnosis usually can be made relatively early. As a rule long before the patient complains of any pain a definite localized point of tenderness may be elicited over the tip of the twelfth rib on the right side. In those cases with infection in the infra-hepatic space tenderness and rigidity can be elicited in the right subcostal region. The patient may complain of pain in the lumbar region next to the vertebral column; the pain at times may be referred to the supraclavicular region through the phrenic nerve. If the condition is allowed to progress without the institution of therapy, an irritative pleurisy is apt to result, due to the passage of toxins through the diaphragmatic lymphatics. For this reason, these cases are often misdiagnosed as pleurisy. It might be said, at this point, that any individual who is recovering from an acute attack of appendicitis and who develops a pleurisy should be considered as having a localized infection in the subphrenic space until proven otherwise. Preceding this, however, there is evidence of decrease movement of the affected leaf of the diaphragm. These two phenomena can best be observed fluoroscopically. The text-book picture of subphrenic abscess which is given so often is seldom seen. The high elevation of the diaphragm, below which a gas collection overlies fluid, represents a late stage of the condition. Unless there has been perforation of a hollow viscus, allowing the escape of gas into the free peritoneal cavity, this picture should never be seen in subphrenic abscess, as it indicates a considerably delayed diagnosis. We agree with Lockwood and Hodges that an exploratory puncture is not justifiable in suspected cases of subphrenic abscesses, because of the danger

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of infecting a virgin pleural cavity. The only justification for it is to determine the type of pleural fluid in those cases in which empyema might be suspected.

The prognosis in subphrenic abscess is bad. The mortality of the reported cases varies from 23 per cent. to 100 per cent. (Douglas 33 per cent.); Hodges, 50 per cent.; Eicher and Kidzey, 50 per cent.; Bauman, 66 per cent.; McEachern: cases operated—33 per cent., not operated—75 per cent.; Tuft, 66 per cent. Fifield and Love report a mortality of 50 per cent. in all their cases. Of 59 cases operated upon there was a mortality of 32 per cent. Lockwood states that in the unoperated cases there is a mortality of from 85 per cent. to 100 per cent., whereas in the operated cases there is a mortality of 66 per cent. Of 15 cases reported by Ochsner there was 1 death, a mortality of 6.6 per cent.

Treatment.—The treatment of subphrenic infection may be divided into three types: (1) Prophylactic treatment, which consists of placing all patients with generalized peritoneal infection in the extreme Fowler's position and an institution of the other measures employed in peritonitis. The conservative treatment in late cases of appendicitis will prevent many subphrenic infections. Fifield and Love found that in 228 cases treated conservatively at the London hospital a subphrenic abscess occurred in only 1 case, whereas in 1,109 cases subjected to immediate operation 7 were complicated by subphrenic abscess.

(2) Conservative treatment: In all cases of subphrenic infection conservative treatment is indicated, as most of these subside spontaneously. When the proper conservative therapy is instituted, it is usually not necessary to resort to operative therapy. The conservative treatment consists of immobilization of the affected side by means of adhesive plaster, the application of heat to the affected side, preferably in the form of dry heat, in addition to the general supportive measures as outlined above.

(3) Treatment of the abscess *per se* consists of incision and drainage. Because of its location a subphrenic abscess offers certain technical difficulties in approaching it. The two routes which have been most frequently used are the transpleural and the transperitoneal. The drainage of any suppurative process through an uninvolved serous cavity is not, however, a sound surgical principle. The results obtained following such a procedure bear out this statement. Fifield and Love report a mortality of 43.7 per cent. in those cases which were drained transpleurally, a mortality of 23.8 per cent. in those drained through the abdominal wall and a 16.7 per cent. mortality in those drained through the loin. That an infection of either the pleural or peritoneal cavity is responsible for the high mortality is probable. It is not only possible and desirable but imperative in all cases of subphrenic abscess to drain extrapleurally and also extraperitoneally. An abscess located in the right superior posterior space, which is the most frequent site of a subphrenic abscess complicating appendicitis, is best drained by the retroperitoneal route. This technic has been described in detail in

previous publications (Nather and Ochsner), and will be only mentioned here. It consists of resection of the twelfth rib, following which a transverse incision is made through the soft parts at the level of the spinous process of the first lumbar vertebra. In this way the pleura is avoided. The incision is carried down to the renal fascia which is continuous above with the peritoneum. The renal fascia is followed upward to the peritoneum, which is then readily separated from the under surface of the diaphragm. A needle is inserted into the subhepatic region, in order to determine whether or not there is an associated subhepatic abscess. If no pus is obtained, separation of the peritoneum from the under surface of the diaphragm is continued until the abscess on the upper surface of the liver is encountered. By means of the finger the abscess cavity is opened and drained without passing through uninvolved peritoneum or pleura. In those cases in which the abscess points anteriorly a similar procedure may be used, as first advocated by Clairmont. An incision is made along the costal margin down to the peritoneum. Without opening the peritoneal cavity the peritoneum is dissected from the under surface of the diaphragm until the abscess cavity is reached. This cavity also is opened bluntly without transversing the free peritoneal cavity. By employing the retroperitoneal operation Ochsner reported 15 cases of subphrenic abscesses complicating appendicitis, with a mortality of 6.6 per cent.

Laurell and Westerborn have recently demonstrated that in many cases with intra-abdominal residual abscesses a flat röntgenogram of the abdomen is of value in localizing the suppurating processes.

The following case is reported because of the development of many of the above-mentioned complications, *i.e.*, right iliac infection, left-sided infection, subphrenic infection, and cul-de-sac abscesses.

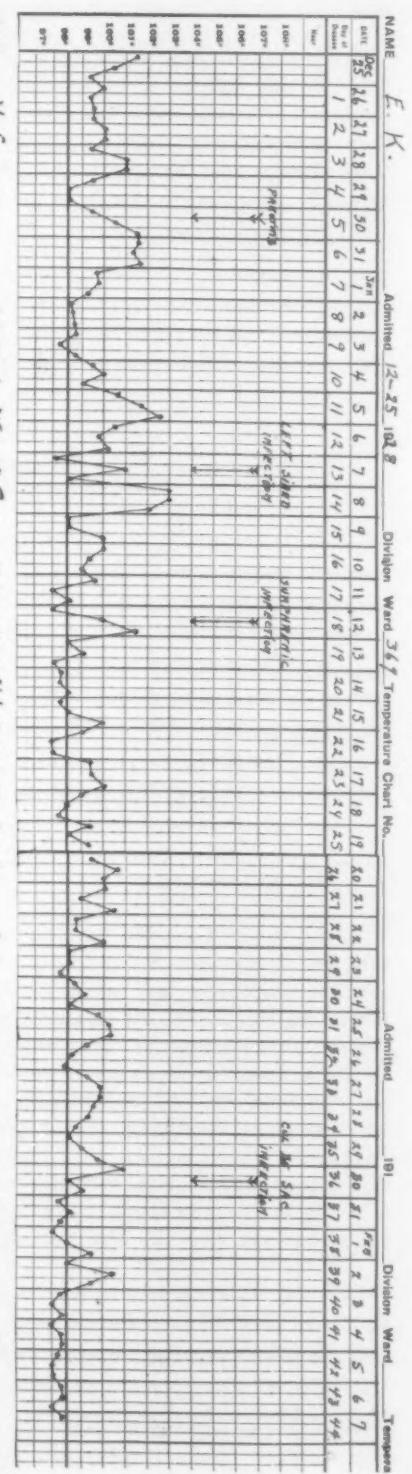
E. K.—(Fig. 5); white; female; aged twelve years. Admitted to the Charity Hospital, December 26, 1928, with temperature of 101.8, pulse 124, and respiration 24, complaining of pain in the right side of the abdomen. Onset of symptoms was forty-eight hours previously, beginning with pain and nausea. Vomiting appeared twenty-four hours later. Pain was worse in umbilical region. At the end of twelve hours it became localized in right side, but upon admission to the hospital pain was diffuse. History of fever 102 degrees on day prior to admission; no previous attacks similar to present one. Usual diseases of childhood. Family history irrelevant. Upon examination the child exhibited very little evidence of acute pain and did not seem extremely toxic. The physical examination was negative except that the abdomen was found to be diffusely rigid and tender, especially in the right lower quadrant.

The blood, on examination, showed: Red blood cells—4,520,000; white blood cells—28,100; 6 per cent. small mononuclear; 10 per cent. large mononuclear; 84 per cent. neutrophils.

Urinalysis showed a slight trace of albumin with many red blood cells, but was otherwise negative.

Patient was put to bed in Fowler's position; heat applied to the abdomen; nothing given by mouth; proctoclysis of glucose, 5 per cent. and normal saline, and hypodermoclysis of saline administered. Conservative treatment continued with improvement until December 30, 1928, when patient developed a right parotiditis with elevation of temperature to 101.4. Heat applied to face and gum given to chew. The temperature

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EG 5

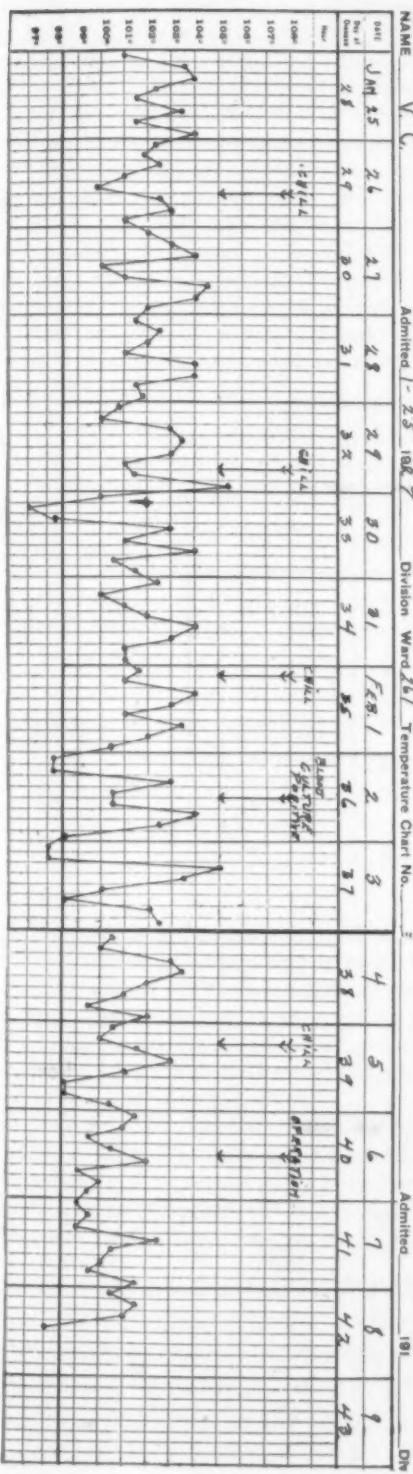


FIG. 6

Fig. 5.—Temperature curve of patient E. K., who developed a number of complications following appendicitis. The first arrow indicates a rise in temperature caused by a parotiditis, the second arrow indicates the development of a left-sided infection, the third arrow indicates the development of a subphrenic infection, and at the fourth arrow a cul-de-sac abscess had developed, which drained spontaneously through the vagina.

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gradually returned to normal on January 3, 1929. On January 5, 1929, patient began to complain of pain in left side of abdomen. Abdomen was greatly distended. Palpation of the abdomen showed a definite rigidity in the left lower quadrant just above Poupart's ligament, and upon rectal examination a marked tenderness was elicited in left side of the pelvis. Temperature was 102.4 on January 5, 1929. Conservative treatment was continued and patient was supported by hypodermoclysis and proctoclysis, there being nothing allowed by mouth. Temperature reached a maximum of 103 on January 8, 1929, accompanied by exacerbation of pain in the left side. Improvement was slow, but temperature became normal on January 11, 1929. The next day, however, the patient complained of pain in the right hypochondrium and exhibited symptoms of sepsis, a few signs of acidosis, and a temperature of 101.6 degrees. Glucose, 5 per cent., 500 cubic centimetres, was given by infusion. Symptoms began to subside and temperature became normal on January 14, 1929. From January 15, 1929, to January 30, 1929, the patient gradually improved but ran a hectic temperature from 100.4 to normal. On January 30,

TABLE V
PYLEPHLEBITIS

Compilation of cases of acute appendicitis showing the incidence of pylephlebitis

Author	Cases of Acute Appendicitis	Cases of Pylephlebitis	Per Cent. of Cases	Author	Cases of Acute Appendicitis	Cases of Pylephlebitis	Per Cent. of Cases
Stillman.....	545	2	.14	Gibson.....	782	1	.13
Hoffman.....	4,000	7	.17	Braun.....	600	8	1.3
Moschowitz.....	1,529	7	.45	Colp.....	2,841	9	.3
Brutt.....	2,500	15	.61	Reock.....	147	2	1.3
Gerster.....	1,187	9	.76	Bell.....	1,726	8	4.6
Quertz.....	533	4	.75	Petren.....	170 ¹	14	8.2
Clairmont and Meyer.....	1,187	4	.33	Armstrong.....	546 ¹	28	5.1
Fitz.....	257	11	.4	Langdon-Brown ²	9,494	12	.12
	Suppurative						

¹ Fatal cases of appendicitis.

² Necropsies.

1929, the temperature was 101 degrees, and rectal examination showed bulging, tenderness, and induration on the anterior wall of the rectum. On January 31, 1929, under ethylene anaesthesia, anal sphincter dilated. No pus could be aspirated from the mass felt in the cul-de-sac. At this time a discharge from the vagina was noticed. It was thought probable that the cul-de-sac abscess had ruptured spontaneously into the vagina. Drainage from the vagina continued and temperature became normal on February 2, 1929. All symptoms subsided and on February 16, 1929, abdominal operation was performed under ethylene anaesthesia. The appendix was removed and the peritoneal cavity carefully explored. Adhesions were found between the superior surface of the right lobe of the liver and the diaphragmatic peritoneum. The omentum in umbilical region was adherent to loops of small intestine, and in the left lower abdominal quadrant these adhesions were divided. The post-operative course has thus far been uneventful.

Portal Thrombophlebitis or Pylephlebitis.—Loisson gives Waller credit for first describing, as early as 1846, a suppurative portal phlebitis and hepatic abscesses following a perityphilitic infection. From the accompanying table (Table V) it can be seen that this complication occurs frequently enough to be appreciated. The incidence varies, according to different statistics, from about .1 per cent. to 1 per cent. of cases of acute appendicitis,

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and occurs in about 5 per cent. of patients dying of peritonitis. Polya believes that pylephlebitis occurs in from .5 per cent. to .7 per cent. of all cases of acute appendicitis and in 5 per cent. of all the fatal cases. That appendicitis may be the most frequent cause of a pylephlebitis or liver abscess has been stressed by many. Brugemann states, "We now know that in the non-tropical country appendicitis is the most common cause of hepatic abscess." Hart, however, found that of 17 cases of liver abscess, resulting from infection of the portal vein, the infection originated in the appendix in only 3. Although it is possible to have an infection of the portal system in cases of appendicitis which have not perforated, this occurrence is rare. As described by Aschoff, an inflammatory process in the appendix, if allowed to progress, produces an infarction and thrombosis in the venules of the appendix. This process may extend to the larger vessels of the meso-appendix and produce a necrosis of the entire appendix. The blood supply of the wall of the appendix nearest the mesentery is poorer than elsewhere. Infection at this point is more likely to extend deeply into the meso-appendix. Infected thrombi may extend from the appendiceal vein through the ileo-colic vein, the superior mesenteric vein, the portal vein, and into the liver. Thalheimer has shown that frequently in acute appendicitis thrombosis of the appendiceal vessels occurs. Dieulafoy, in a masterful exposition, stated that liver lesions may occur in cases of appendicitis with or without perforation of the appendix. He observed that the infected veins, in one of his cases, became varicosed. He did not believe, however, that organisms gain entrance to the veins of the appendix before the fifth or sixth day. Liver infection may occur by direct extension of the thrombo-phlebitic process in the portal vein, up to the liver, or may be the result of infected emboli which have been carried from the appendiceal veins through the portal system to the liver. It is possible that the portal vein may become secondarily infected from a retroperitoneal phlegmon which has extended up from the appendiceal region. (Melchior.) This, however, is relatively rare. In a case reported by Christopher only portions of the portal vein were destroyed, whereas the other portions were perfectly intact. The blood carried by the portal system from the appendix passes to the liver. Copher and Dick have shown that in the portal vein there are distinct currents which pass from various parts of the portal system to definite portions of the liver. They have shown that when a dye subsidence was injected into a small vein, at the root of the meso-appendix, it was transported to all parts of the liver. A greater proportion of the dye was, however, carried to the left lobe of the liver. Thus, in portal infection it can be seen that multiple abscesses may occur in either the right or left lobe. Probably there is a preponderance of the abscesses on the left side. Such an abscess has been reported by Lissner and Christopher. Right-sided abscesses have been reported by Barnes and Pearson, Babler, Colp, and Burgemann. Whereas the abscesses encountered in pylephlebitis are, as a rule, multiple, single abscesses have been reported by Quénau and Mathieu, who, in addition to

their own cases, collected two unpublished cases of Jalaguier and 14 others in the literature. All of these cases were operated on; 12 recovered, and 2 died of other complications. Solitary abscesses have been reported by Burgemann and Eliason.

The prognosis in this condition is extremely bad. Dieulafoy states, "This hepatic infection is one of the most dangerous complications of appendicitis, because I am only acquainted with two cases which have recovered." Lissner is of the opinion that no operative procedure will save a patient once the infection has gotten into the portal vein. Thalheimer has also emphasized the bad prognosis. In spite of the bad prognosis, not a few number of recoveries have been reported (Kelly, Hillstroem, Quénau and Mathieu, Scott, Colp, Farmer, Brogden, Eliason, Reock, Melchior, Braun, Brugemann, and Barlow).

Symptoms and Signs.—The symptoms and signs of pylephlebitis are quite characteristic—so much so that it is an omission on the part of the surgeon to overlook this condition when these signs and symptoms are present. It is only necessary to keep the condition in mind, in order to be able to make a diagnosis. Gerster, in 1903, stated, "Chills accompanied by a rapid rise in temperature during the course of appendicitis, however mild as to local symptoms, may, and usually do, signify the entrance of a septic material into the portal and general circulation. It must be looked upon as a sign of gravest importance." This important observation was little heeded until the past decade. Thalheimer, in 1921, emphasized the importance of chills occurring pre-operatively in cases of acute appendicitis, and urged that at the time of the original operation examination be made of the vessels in the ileo-colic and mesenteric vessels. He considers that the most important single symptom in pylephlebitis is the presence of chills followed by high temperature, and believes that all patients with acute appendicitis should be asked if they have had chills previous to admission to the hospital. If chills have occurred, the probability of a beginning thrombosis of the appendiceal vessels and possibly of some of the larger radicles of the portal system should be considered. Melchior believes that there are two types of appendicitis which are apt to cause portal infection. First, those in which the portal infection occurs primarily and early in the disease. In this type of case the appendix is invariably gangrenous. Second, those in which the gangrene of the appendix is more or less localized and there is only one point of perforation. He states that a pathognomonic sign of portal empyema is recurring chills. The presence of chills as an initial symptom in appendicitis is an absolute indication for early operation. Melchior states that if a chill occurs either before or after an appendectomy the cause of which is not erysipelas, pneumonia, tonsilitis, or cholangitis, then one must first think of portal infection. If the chill recurs a diagnosis of pylephlebitis is justifiable, and the patient should be given the advantage of an operative interference. From the above it can be seen that the most prominent, and therefore the most important, objective symptom in pyle-

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phlebitis is recurring chills associated with fever and profuse sweats. In addition to these symptoms, there may be slight jaundice, which appears relatively late. The patient may or may not complain of pain in the right upper abdominal quadrant in the region of the liver. Palpation usually reveals a large tender liver. Due to the increased size of the liver, the diaphragm is often forced upward and compresses the lower part of the lung. Because of this, frequently an intra-thoracic lesion is erroneously diagnosed. In addition to these symptoms and signs, there are the usual positive laboratory findings for acute infections within the abdomen.

Treatment.—The treatment of pylephlebitis should first be prophylactic. As emphasized by Melchior and others, there is a very high mortality, and because this complication is much more apt to occur in cases of suppurative appendicitis, the best treatment consists of the removal of the infected focus before the process has extended to the radicles of the portal system. The importance of early removal of the appendix has been emphasized by Petren. Of his 18 cases only 6 had been operated upon within the first week of the disease. Thalheimer, Melchior, and others have emphasized that it is essential in those cases of appendicitis which give a history of chills occurring pre-operatively to carefully examine the appendiceal, the ileo-colic, the superior mesenteric vessels, and even the portal vein at the time of operation. If pylephlebitis has occurred and is recognized either at the time of operation or post-operatively, the treatment is surgical. Gerster, in 1903, advised the incision and drainage of the infected and thrombosed vein. Wilms, following the reasoning of Trendelenburg in ligating the ovarian vein in puerperal sepsis, in 1909, advocated the ligation and incision of the veins of the ileo-cecal angle. He reported a case treated successfully in this manner. Sprengel performed the procedure, as advocated by Wilms, several days after an appendectomy. However, the patient died three weeks later of pylephlebitis and liver abscess. In those cases of acute appendicitis in which a thrombosis of the ileo-cecal vein is suspected, Thalheimer advised the division of the meso-appendix without clamps, in order to see whether or not bleeding occurs. Reock is of the opinion that the Wilms operation is not desirable in cases of pylephlebitis, because the process has usually extended beyond the ileo-cecal area. Braun, in 1913, advocated the ligation of the ileo-colic vein in cases of pylephlebitis. He reported two cases so treated successfully. Melchior, in 1928, collected 13 cases in which the Braun procedure had been performed in cases of pylephlebitis. These he divided into 2 groups: First, those in which the veins were attacked at the original operation, when the appendix was removed. There are 8 cases in this group and all were cured. Second, those cases in which the veins were attacked secondarily, after the primary operation. There are 5 cases in this group, there being only one cure and four deaths. This author reports a successful operation, according to the Braun technic, performed in a case of pylephlebitis. Neuhof produced experimental portal obstruction in animals. Because he produced complete portal obstruction with success, he suggested that

ligation of the portal vein might be performed in cases of suppurative pylephlebitis. He found that it was impossible to completely obstruct the portal vein at one time, as first collateral circulation had to be produced. Beer, following the experimental work of Neuhof, attempted to ligate the portal vein in a case of pylephlebitis. Before resorting to ligation of the vein, however, an attempt was made to increase the collateral circulation by anastomosing the spermatic vein with a branch of the inferior mesenteric vein. This, however, was unsuccessful. An omentopexy was then performed. Three days later the portal vein was ligated and cholecystostomy performed. Following this, the patient's jaundice became less. He, however, died forty-eight hours later. Colp, in 1926, reported 4 cases of pylephlebitis in which a ligation of the portal vein was performed. All cases, however, ended fatally. From these results it is apparent that in cases with pylephlebitis severe enough to necessitate the ligation of the portal vein such a procedure is of no avail. Once the infection has gained entrance to the liver and there is evidence of hepatic suppuration little can be done unless the infection occurs as a solitary abscess, which is rare. The presence of such an abscess is an indication for incision and drainage.

The following case illustrates the usual clinical course in pylephlebitis:

V. C.—(Fig. 6) ; female; aged ten years. Admitted to Charity Hospital, January 25, 1929; died February 8, 1929. *Chief complaint.*—Pain in the abdomen and fever. Illness began acutely about four weeks ago, when child was taken sick with a rather severe abdominal pain and fever. She had a slight cough at the time of the onset of illness. Since the illness began pains have persisted, and the child has vomited frequently. Child's father was unable to say definitely whether the child has had diarrhoea, but thinks she has had three or four bowel movements daily. Child has had frequent chills since illness began, sometimes two to three chills a day. Appetite has been poor. When admitted she appeared to be ill and very toxic. Is somnolent and uninterested in anything going on about her. Coughs at intervals and expectorates a purulent sputum. Head and thorax negative.

The abdomen was visibly distended. The child complains of epigastric pain and tenderness and rigidity in the epigastrium, as well as the right upper quadrant. Liver and spleen are not palpable. No other areas of tenderness or rigidity.

Extremities: negative. Because of the above symptoms and findings, a provisional diagnosis of typhoid fever was made.

Laboratory findings.—Urine—turbid; acid reaction; faint trace of albumin; occasional pus cell. Blood—white blood cells, 1,850,000; red blood cells, 15,000; haemoglobin, 30 per cent.; neutrophils, 79 per cent. Weidal reaction: negative. No malaria plasmodia found in blood.

The patient was put on typhoid diet and given glucose by rectum, subcutaneously, and intravenously. X-ray of the chest, taken on February 1, showed no evidence of pathology within the thorax. The cardiac shadow is enlarged. Blood culture, taken February 2, is positive for *B. coli*. February 5: An attempt is made to aspirate the right chest. Puncture was done in the eighth interspace in the midaxillary line. A foul smelling pus suggested that the *B. Coli* was obtained. This culture was found to be *B. Coli*.

X-ray of the chest shows that the right diaphragm is higher than normal, probably the result of a subdiaphragmatic pathology. Patient was seen by a surgical consultant, Doctor Snelling, who suggested the possibility of a subphrenic abscess, and advised transfer to the surgical service.

February 6: Under general anaesthesia resection of twelfth rib on the right side and

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an exploration of the subphrenic space on the right side extraperitoneally. Nothing was found in the subphrenic space. A needle was introduced into the liver, from which a large quantity of foul smelling pus was evacuated. The cavity was opened and drainage tube inserted. Transfusion of 150 cubic centimetres of citrated blood.

The patient's condition remained about the same. There is a considerable discharge from the wound. On February 8, another transfusion of 200 cubic centimetres of blood was given. Patient was supported also by the administration of 10 per cent. glucose intravenously. Patient gradually grew weaker, and died on February 8.

Autopsy.—(Doctor Miller.) The peritoneal cavity was found to be free, except for some plastic exudate over the loops of small bowel. There was, however, no evidence of inflammation of the serosa of the small bowel. In the region of the inlet of the pelvis was a small abscess into which the stump of the appendix protruded. The appendix in its distal portion was cystic, and was surrounded by the above-named abscess. The liver contained multiple abscesses, several large ones being located on the right, one of which had been drained surgically. On the left were a large number of smaller abscesses. A hydrop of the gall-bladder was also present, an abscess of the spleen, and there was a pericarditis with effusion.

CONCLUSIONS

1. Post-operative intra-abdominal complications of appendicitis depend largely upon the extent of the infection. In from 26 per cent. to 100 per cent. of cases of acute appendicitis the infection has extended beyond the appendix when the patient is admitted to the hospital.

2. The usual intra-abdominal complications are peritonitis, ileus, residual abscesses, and pylephlebitis.

3. Peritonitis is the cause of death in from 65 per cent. to 77.5 per cent. of cases dying of appendicitis.

4. Ileus comprises from 6 per cent. to 15 per cent. of all post-operative complications of appendicitis.

5. Residual peritoneal abscesses occur in from 1.8 per cent. to 5.7 per cent. of all cases of acute appendicitis.

6. Abscess in the cul-de-sac of Douglas is the most frequent intra-abdominal residual abscess.

7. Abscesses occur in the right iliac fossa, subphrenic space, and the left side.

8. Pylephlebitis is the most serious complication occurring after appendicitis.

BIBLIOGRAPHY

Abbadie : Les abcès du foie. Thèse, Bordeaux, 1903.

Abbott, W. R. : Appendicitis followed by Multiple Abscesses of the Liver. Cincinnati Med. News, vol. ii, p. 78, 1915.

Allen, A. W. : An Important Complication of Acute Appendicitis. Cabot Case Records, Boston M. & S. Jour., vol. xciv, pp. 1097-1099, 1926.

Armstrong : Cited by Colp.

Ashurst, A. P. C. : Appendicitis Complicated by Subphrenic Abscess. ANNALS OF SURGERY, vol. liii, p. 118, 1911.

Babler, E. A. : Pylephlebitis Complicating Appendicitis. ANNALS OF SURGERY, vol. lxi, p. 589, 1915.

Bancroft, F. W. : Acute Appendicitis. A Review of 584 Consecutive Cases. J. A. M. A., vol. lxxv, p. 1635, 1920.

Barlow, R. A. : Case of Acute Appendicitis: Suppurative Pylephlebitis; Recovery. London, Lancet, vol. i, p. 844, 1919.

OCHSNER, GAGE AND GARSIDE

- Barnes, F. L.: Major Post-operative Conditions Following Acute Suppurative Appendicitis. *South. M. J.*, vol. ix, p. 558, 1926.
- Barnes, W. A., and Pearson, L. V.: Suppurative Pylephlebitis and Hepatic Abscesses Complicating Appendicitis. A Case of Recovery. *Brit. Med. Jour.*, p. 390, March 10, 1928.
- Bauer, F.: Zur Behandlung der acuten, freien, eitrigen Peritonitis, mit besonderer Berücksichtigung auf die Frage der Primärnaht. *Arch. f. klin. Chir.*, vol. xlvi, p. 938, 1911.
- Baumann, Max: Zur Kenntnis des subphrenischen Abscesses; Bruns Beiträ. z. klin. Chirurg., vol. cxxviii, pp. 477-480, 1923.
- Beekman, Fenwick: Acute Appendicitis in Childhood. A Study of 145 Cases Observed at Bellevue Hospital of New York City. *ANNALS OF SURGERY*, vol. lxxxix, p. 538, 1924.
- Beer, Edwin: Ligation of the Portal Vein in Suppurative Portal Phlebitis. *Am. J. M. Sc.*, vol. cl, p. 548, 1915.
- Bell, J.: Portal Infection Originating in Appendicitis. *Montreal Med. Jour.*, vol. xxxvii, p. 870, 1908.
- Berman, Jacob B.: Subphrenic Abscess. *Jour. Indiana State Med. Asso.*, vol. xviii, pp. 217, 461, 1925.
- Binney, Horace: Subphrenic Abscess Following Appendix Abscess During Pregnancy. *Boston M. & S. Jour.*, vol. cxlvii, pp. 773-774, 1927.
- Box and Russel: Some Observations on Intraperitoneal Suppuration in the Upper Half of the Abdomen. *St. Thomas Hosp. Rep.*, vol. xxvi, p. 46, 1897.
- Braun, H.: Die Unterbindung der Vena ileocolica bei mesenterialer Pyämie nach Appendizitis. *Beitr. z. klin. Chir.*, vol. lvi, pp. 314-326, 1913.
- Brogden: Cited by Colp.
- Brugemann, H. O.: Isolated Abscess of the Liver Complicating Appendicitis. *ANNALS OF SURGERY*, vol. lxv, p. 462, 1917.
- Bryant: Cited by Christopher.
- Cabot: Case Records No. 13113. An Uncommon Cause for Sciatica and Abdominal Tumor. *Boston M. & S. Jour.*, vol. cxvii, p. 448, 1927.
- Chiari, O. M.: Beiträge zur Kenntnis und Behandlung der Appendixperitonitis. Beiträge z. klin. Chir., vol. cxx, p. 326, 1920.
- Christopher, Frederick: Pylephlebitis of Appendiceal Origin Simulating Lung Abscess. *Surg. Clin. N. A.*, vol. i, p. 1093, 1921.
- Clairmont, P., and Meyer, M.: Erfahrungen über die Behandlung der Appendicitis. *Acta Chir. Scand.*, vol. Ix, p. 55, 1926.
- Clendening, Logan: Subphrenic Infection. Cases Illustrative of the Different Forms of this Condition. *Med. Clin. N. A.*, vol. vi, p. 775, 1926.
- Clute, H. M.: Subphrenic Infection after Appendicitis. *Surg. Clin. N. A.*, vol. vi, p. 775, 1926.
- Idem*: Enterostomy in Peritonitis. *Surg. Clin. N. A.*, vol. viii, p. 129, 1928.
- Colp, Ralph: The Treatment of pylephlebitis of Appendicular Origin with Report of Three Cases of Ligation of the Portal Vein. *Surg. Gynec. & Obst.*, vol. xliv, p. 627, 1926.
- Copher, Glover H., and Dick, Bruce M.: Stream Line Phenomena in the Portal Vein and the Selective Distribution of Portal Blood in the Liver. *Arch. Surg.*, vol. xvii, p. 408, 1928.
- Cottle, G. F.: A Case of Subphrenic Abscess. *U. S. Navy M. Bull.*, vol. xix, pp. 683-685, 1923.
- Cutler, C. W.: Post-operative Complications of Suppurative Appendicitis. *Am. Jour. Surg. N. S.*, vol. iii, p. 603, 1927.
- Deaver, John B.: Appendiceal Peritonitis. *Surg. Gynec. and Obst.*, vol. xlvi, p. 401, 1928.

INTRA-ABDOMINAL POST-OPERATIVE COMPLICATIONS

- Idem:* Sequelæ of Suppurative Appendicitis. *Surg. Clin. N. A.*, vol. iii, p. 29, 1923.
Deaver, J. B., and Magown, J. A. H.: Review of 5,488 Appendectomies Performed at Lankenau Hospital of Philadelphia. *ANNALS OF SURGERY*, vol. Ixxvii, p. 854, 1924.
Delatour, H. B.; Pelvic Abscess Following the Fowler Position in Appendicitis. *New York Med. Jour.*, vol. ci, p. 298, 1915.
Dexter, R.: Observations in the Diagnosis of Subphrenic Abscess. *Am. J. M. Sc.*, vol. clxx, p. 810, 1925.
Dieulafoy, G.: A Textbook of Medicine. D. Appleton & Co., New York, vol. i, 1911.
Douglas, John: Subdiaphragmatic Abscess and Accumulation of Fluid. *ANNALS OF SURGERY*, vol. Ixxix, pp. 845-853, 1924.
Idem: Subphrenic Abscess Complicating Appendicitis. *Surg. Gynec. and Obst.*, vol. xiv, p. 170, 1912.
Dudley, Guilford S.: Paralytic Ileus as a Complication of Acute Appendicitis. *ANNALS OF SURGERY*, vol. Ixxxiv, p. 729, 1926.
Duettmann, Dr.: Ueber Appendizitisrezidive nach appendizitischen Abscessen. *Münch med. Wochenschr.*, vol. Ixxii, p. 1370, 1925.
Eicher, Chas. G., and Kibzey, Ambrose T.: Subdiaphragmatic Abscess. *Atlantic Med. Jour.*, vol. xxviii, pp. 30-32, 1924.
Eisendrath, D. N.: Complications of Appendicitis. *Surg. Clin. N. A.*, vol. i, p. 1035, 1917.
Eliason, E. L.: Pylephlebitis and Liver Abscess Following Appendicitis. *Surg. Gynec. and Obst.*, vol. xlvi, p. 510, 1926.
Idem: Subdiaphragmatic and Liver Abscess Following Appendicitis. *ANNALS OF SURGERY*, vol. Ixxxiv, p. 116, 1926.
Farmer, A. W.: Appendicitis Complicated by Septic Portal Thrombosis. *M. J. Australia*, vol. ii, p. 8, 1923.
Fifield, L. R., and Love, R. J. M.: Subphrenic Abscess. *Brit. Jour. of Surg.*, vol. xiii, p. 683, 1926.
Fitz, Reginald: Cited by Christopher.
Frank, Jacob: Secondary Parotitis Following Operations for Appendicitis. *Surg. Gynec. and Obst.*, vol. xiv, p. 469, 1912.
Garlock, John H.: Appendectomy Wound Repair and Hernia. *ANNALS OF SURGERY*, vol. Ixxxix, p. 282, 1929.
Gatch, W. D., and Durman, D. C.: A Report of 262 Consecutive Cases of Appendicitis. *ANNALS OF SURGERY*, vol. Ixxix, p. 862, 1924.
Gerster: Cited by Christopher.
Gibson, Chas. L.: Analysis of Results of Six Years' Follow-up System in a Hospital Surgical Service. *ANNALS OF SURGERY*, vol. lxx, p. 661, 1919.
Golbraith, Walter W.: Appendix "Pinned" to the Liver. *Brit. Jour. Surg.*, vol. xiii, p. 749, 1925-1926.
Graffagrino, P.: Acute Appendicitis a Surgical Problem. *New Orleans M. & S. Jour.*, vol. lxxv, p. 277, 1922.
Guerry, Le Grand: A Study of the Mortality in Appendicitis. *ANNALS OF SURGERY*, vol. Ixxxiv, p. 283, 1926.
Haeberlin, Doctor: Über die Behandlung der zirkunskripten und diffusen eitrigen Peritonitis im Gefolge der Appendicitis. *Beiträge z. klin. Chir.*, vol. xc, p. 99, 1914.
Hall, J. N.: Abscess of the Lung from Ascending Infection from Appendicitis. Report of Cases *Med. Rec.*, vol. lxxiv, p. 665, 1908.
Hart: Cited by Christopher.
Hillstroem, N.: Zur spontan Heilung der eitrigen Hepatitis nach Appendicitis. *Beit. z. klin. Chir.*, vol. lxxx, p. 546, 1912.
Hirsch, C.: Zur Technik der Probepunktion bei rechtsseitigem subphrenischen Abscess. Mitteit, a. d. Grenzgeb. d. Med. u. Chirurg., vol. xxxv, pp. 595-597, 1922.
Hodges, Fred M.: Subdiaphragmatic Abscess. *J. A. M. A.*, vol. lxxx, p. 1058, 1923.

OCHSNER, GAGE AND GARSIDE

- Hoffman: Cited by Lett.
- Homans, John, and Powers, John H.: Appendiceal Abscess: Treatment of the Appendix. *New Eng. Jour. of Med.*, vol. cxcix, p. 319, 1928.
- Jopson, J. H.: Subphrenic Abscess Following Appendicitis. *ANNALS OF SURGERY*, vol. li, p. 426, 1910.
- Jopson, J. H., and Pfeiffer, D. B.: The Limitations of the Ochsner Treatment in Certain Cases of Suppurative Peritonitis, *ANNALS OF SURGERY*, vol. lxxvii, p. 104, 1923.
- Jukelsohn, M. B.: Soll man appendekтомieren "a froid" bei Kranken nach ueberstandenem appendikulaerem Abscess? *Norry Chir. Arch.*, vol. xliv, p. 453, 1927; abs. *Zentralbl. f. Chir.*, vol. liv, p. 1931, 1927.
- Kelly, W. R.: Acute Appendicitis; Liver Abscess; Recovery. *Jour. Royal Army Med. Corp.*, vol. xxi, p. 688, 1913.
- Kuemmel: Wodurch setzen wir die Mortalität der Appendicitis herab und verhüten Abscesse und Peritonididen. *Verhandl. d. deutsch. Gesellsch. f. Chir.*, Berl., vol. xxxix, Pt. 2, pp. 1-44, 1910.
- Langdon-Brown: Cited by Christopher.
- Laurell, H., and Westerborn, A.: Ein Beiträge zur Röntgendiagnose abgekapseleter, intraperitonealer Eiteransammlungen, beleuchtet durch einen von diagnostischen und therapeutischen Geischtspunkt aus interessanten Fall von multiplen Abscessen in der Bauchhöhle nach Appendicitis. *Arch. f. klin. Chir.*, vol. cxlvii, p. 593, 1927.
- Lett, Hugh: The Present Position of Acute Appendicitis and Its Complications. *Lancet*, vol. i, p. 295, 1914.
- LeWald, L. T.: Abscess and Its Differential Diagnosis Röntgenologically Considered. *Arch. Surg.*, vol. x, pp. 544-556, 1925.
- Liebmann, E., and Schinz, H. R.: Beiträge zur Kenntnis zirkumskripter Abscessbildung im Abdomen. *Deut. Zeit. f. Chir.*, vol. clix, p. 389, 1920.
- Lissner, H. H.: Pylephlebitis Following Appendicitis, with Report of a Case. *J. A. M. A.*, vol. lxvi, p. 1450, 1916.
- Lockwood, A. L.: Subdiaphragmatic Abscess. *Surg., Gynec. and Obst.*, vol. xxxiii, pp. 502, 516, 1921.
- Loison, Ed.: Des suppurations intra et périhépatiques d'origine typho-appendiculaire. *Rev. de chir.*, Paris, vol. xx, p. 522, 1900.
- Lotsch, Fritz: Krankheitsbild des subphrenischen Abscesses. *Kinische Wochenschrift*, vol. xxx, pp. 2012-2014, 1924.
- Maes, Urban: Appendicitis in the Aged. *New Orleans Med. and Surg. Jour.*, vol. lxxviii, p. 117, Sept., 1925.
- Marsch: Erfahrungen und resultate an 9000 Appendectomien. *Beitr. z. klin. Chir.*, vol. cxxvi, p. 67, 1922.
- Martin, Walton: Late Abscess Following Appendicitis. *ANNALS OF SURGERY*, vol. lxxxix, p. 617, 1924.
- McEachern, John D.: Closed Drainage in Subphrenic Abscess. *Surg. Gynec. and Obst.*, vol. xlili, 1924.
- McWhorter, Golder L.: Non-perforative Appendicitis Followed by Peritonitis. *Ill. M. Jour.*, vol. xl, p. 109, 1921.
- McWilliams, C. A.: Cited by Lett.
- Melchior, Edward: Zur Kenntnis der portalen Infektion im Gefolge der Appendicitis und ihrer Behandlung mittels Venenligature. *Beiträge z. klin. chir.*, vol. cxlii, p. 795, 1928.
- Idem*: Über spät Abscesse nach Appendicitis. *Berlin Klin. Wehnschr.*, vol. I, p. 1887, 1913.
- Idem*: Über erfolgreiche sekundäre Ausführung der Braunschen Operation (Ligatur der Vena ileo-colica) bei postappendicitischer Thrombophlebitis meseraica. *Zentralbl. f. chir.*, vol. liv, p. 3083, 1927.

INTRA-ABDOMINAL POST-OPERATIVE COMPLICATIONS

- Melinkoff, A.: Die chirurgische Zugänge durch den unteren Rand des Brust-korbes zu den Organen des subdiaphragmalen Rawmes. Deut. zeitschr. f. Chir., vol. clxxxii, pp. 83-151, 1923.
- Idem:* Die chirurgische Anatomie des Sinus costo-diaphragmatim. Arch. f. klin. Chirurg., vol. cxxiii, pp. 133-196, 1923.
- Meyer, Willy: Subphrenic Abscess Following Acute Appendicitis. ANNALS OF SURGERY, vol. li, p. 590, 1910.
- Moore, Sherwood: The Röntgenological Findings in a Case of Pyopneumothorax Sub-phrenicus Dextre. Am. J. Roentgenology, vol. vi, pp. 83-86, 1919.
- Moschowitz, A. V.: Septic Infarct of the Lungs Following Appendicitis. ANNALS OF SURGERY, vol. Ixiii, p. 749, 1916.
- Moschowitz, A. V., and Moschowitz, E.: Zur appendicitis Frage; ein Bericht über 2000 consecutive Fälle von Erkrankungen der Appendix vermicularis, mit besonderer Berücksichtigung der Therapie. Arch. f. klin Chir., vol. lxxxii, p. 683, 1907.
- Munro, J. C.: Lymphatic and Hepatic Infections Secondary to Appendicitis. ANNALS OF SURGERY, vol. xlvi, pp. 627-632, 1905.
- Nather, Karl: Der Prä- oder retro-peritoneale Weg zum subphrenischen Abscess als typische Operation. Archiv. für Klinische Chirurgie, Mit., vol. xxii, p. 3, 1922.
- Nather, K., and Ochsner, Alton: Der Douglas-abszess im Gefolge der geschlossenen Peritonitisbehandlung. Deut. zeit. f. Chir., vol. clxxxviii, p. 124, 1924.
- Idem:* Der linksseitige Abszess bei Appendicitis. Deut. Zeit. Chir. S., vol. clxxxviii, B. 1/2 Heft, pp. 115-123, 1924.
- Idem:* The Left-sided Abdominal Abscess as a Complication of Appendicitis. Surg., Gynec., and Obst., vol. xl, pp. 495-498, 1925.
- Idem:* Retroperitoneal Operation for Subphrenic Abscess. Surg., Gynec., and Obst., vol. xxxvii, pp. 665-673, 1923.
- Idem:* Douglass Abscess Following the Closed Treatment of Peritonitis. Surg., Gynec. and Obst., vol. xl, pp. 258-263, 1925.
- Neuhof, Harold: Experimental Ligation of the Portal Vein: Its Application to the Treatment of Suppurative Pylephlebitis. Surg., Gynec. and Obst., vol. xvi, p. 481, 1913.
- Idem:* Non-suppurative Subphrenic Peritonitis Complicating Appendicitis. Surg., Gynec., and Obst., vol. xiv, p. 231, 1912.
- O'Brien, F. W.: The Röntgen-ray Diagnosis of Subdiaphragmatic Abscess. Boston, M. & S. Jour., vol. cxvii, pp. 518-523, 1927.
- Ochsner, Alton: Subphrenic Abscess. New Orleans Med. and Surg. Jour., vol. lxxxix: No. 2, pp. 102-111, August, 1928.
- Orsos, Eugen: Modifikation der transpleuralen Eröffnung des subphrenischen Abscessen. Zentralbl. f. Chirurg., vol. lii, pp. 1637-1640, 1925.
- Pancoast, Henry K.: The Röntgenological Diagnosis of Liver Abscess with or without Subdiaphragmatic Abscess. Am. Jour. Röntgenology and Rad Therapy, vol. xvi, p. 303-320, 1926.
- Petren, Gustif: Über Leberabscess als Komplikation zu akuter Appendicitis. Beitr. zur klin. Chir., vol. xciv, p. 225, 1914.
- Phillips, John: Subphrenic Abscess. Surg. Clin. of N. A., vol. iv, pp. 907-913, 1924.
- Quain, E. P., and Waldschmidt, R. H.: The Acute Appendicitis, with a Report of 1000 Consecutive Cases. Arch. of Surg., vol. xvi, p. 868, 1928.
- Quenu, E., and Mathieu, P.: Rev. de Chir., vol. xliv, p. 519, 1911.
- Quert: Cited by Colp.
- Reock, Ivan von: Der post appendicitische Leberabscess. Zentralbl. f. Chir. vol. liv, p. 196, 1927.
- Reschke, Karl: Zur Behandlung der allgemeinen freien Appendix peritonitis. Arch. f. klin. Chir., vol. cxlv, p. 533, 1926.

OCHSNER, GAGE AND GARSIDE

- Roger, I. Lee: Subdiaphragmatic Inflammation, with a Syndrome of Physical Signs and Spontaneous Recovery without Suppuration. *J. A. M. A.*, vol. xvi, pp. 1307-1310, 1915.
- Rotter, J.: Zur Behandlung der diffusen Peritonitis. *Arch. f. klin. Chir.*, Berl., vol. lxxxiii, p. 1, 1919.
- Ruge, E.: Darmverschluss bei und nach Perityphlitis. *Arch. f. klin. Chir.*, Berl., vol. xciv, p. 711, 1910-1911.
- Sasse: *Arch. f. klin. Chir.*, vol. xciv, p. 549, 1911.
- Schaer, Werner: Über Todesursachen bei Appendicitis (Hotz) *Brun. Beitr. z. klin. Chir.*, cxxxvii, p. 310, 1926.
- Schlaenge: *Chirurgie des Unterleibes*-Stuttgart, 1900.
- Schlesinger, E. G., and Stengel, Alfred: Hepatic Abscess as a Complication of Appendicitis. *Nelson's Loose Leaf Med.*, vol. v, p. 511, k. and 1.
- Schmidt, E. O.: Zur Behandlung der Appendicitis mit Komplikationen. *Deut. zeit. f. Chir.*, vol. clxxv, p. 212, 1922.
- Scott, W. D.: Report of a Case of Acute Suppurative Appendicitis with Metastatic Hepatic Abscesses: Post-operative Evacuation of Liver Abscesses through the Lung; Complete Recovery. *Hosp. Bull. Univ. of Maryland*, vol. i, p. 151, 1905.
- Sommer, Johannes: Die Röntgenuntersuchung des subphrenischen Abscesses zur Feststellung des Operationsplanes. *Zentralbl. f. Chir.*, vol. 1, pp. 215-216, 1923.
- Sonnenburg, E.: Pathologie und Therapie der Perityphlitis. *Monographie*, vol. 5, auf 1905, auf 1913. Leipzig.
- Sprengel, O.: Zur Frage der Venenunterbindung bei eitriger Pfortaderthrombose nach Appendicitis. *Zentralbl. f. chir.*, Leipz., vol. xxxviii, p. 33, 1911.
- Idem*: Appendicitis. *Deutsch. Chirurgie Lfg.*, vol. xlvi, p. 3, 1906.
- Steichell, H.: Beitrag zur appendicitis Frage an Hand von 1000 Fallen. *Beitrag. z. klin. Chir.*, vol. cxxv, p. 607, 1922.
- Stillman, Alfred: Post-operative Sequelæ in 1748 Cases of Appendicitis. *Med & Surg. Rep. Roosevelt Hosp.*, New York, vol. lxxix, 1915.
- Straus, David: Subphrenic Abscess. Transpleural Drainage Under Paravertebral Anesthesia. *Surg. Clinics N. A.*, vol. 3, pp. 925-939, 1923.
- Suermondt, W. T.: Resultate der chirurgischen Behandlung der Appendicitis beurteilt nach den letzten 1000 Fällen der chir. Klinik zu Leiden. *Deut. zeit. f. Chir.*, vol. clxx, p. 289, 1922.
- Thalheimer, William: Chills Occurring Early in Appendicitis Before Operation and Their Indication of an Operable Stage of Pylephlebitis. *Arch. Surg.*, vol. viii, p. 658, 1924.
- Truesdale, E. D.: The Surgical Treatment of Acute Appendicitis. *ANNALS OF SURGERY*, vol. lxxxiv, p. 104, 1926.
- Tuft, Louis: Subphrenic Abscess—a Clinical Study. *Am. Jour. Med. Sc.*, vol. clxx, pp. 431-441, 1925.
- Ullman, Alfred, and Levy, Chas. S.: Subphrenic Abscess. *Surg. Gynec., and Obst.*, vol. xxxi, pp. 594-600, 1920.
- Vogel: Die Behandlung der Appendicitis an der Chir. Klinik der Univ. Bern. *Arch. f. klin. Chir.*, vol. cxv, p. 1, 1921.
- Wiemer, Paul: Beitrag. zur Klinik des subphrenischen Abscessen. *Munch Med. Wchnschr.*, vol. lxxi, pp. 47-49, 1924.
- Wilms, Prof.: Venenunterbindung bei eitriger Pfortaderthrombose nach Appendicitis. *Zentralbl. f. Chir.* vol. xxxvi, p. 1041, 1909.
- Wolf, E.: Zur Behandlung der appendicitischen Abscesse. *Beitraege z. klin. Chir.*, vol. cxi, p. 263, 1918.

PEPTIC ULCER OF MECKEL'S DIVERTICULUM AND ILEUM

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MECKEL's diverticulum is a structure resulting from the persistence of a portion of the omphalo-mesenteric or vitelline duct. Normally this embryonic structure undergoes complete regression. It may, in rare instances, remain as a completely pervious fistula from the intestine, opening at the umbilicus and discharging intestinal contents. Inversion and prolapse of the ileum may occur through such a fistula. Only the distal portion may fail to involute leaving a mucous-secreting sinus at the navel. If the external orifice also becomes occluded a cyst of the umbilicus results. A mid-portion of the duct may fail to atrophy in which event an enterocystoma is formed. Such enterocysts may be situated entirely in the wall of the terminal ileum. If the entoderm of the duct disappears and its mesodermal covering persists a fibrous cord passing from the ileum to the umbilicus is left, which predisposes to intestinal obstruction by adhesions, angulation, torsion or volvulus of the small bowel.

Commonly, however, only the proximal part of the tract persists leaving a diverticulum arising from the ileum in its terminal two or three feet and communicating freely with its lumen. The pouch is usually 3 to 10 centimetres long, its neck situated at the antimesenteric border of the ileum, and its coats resembling that of the latter in every way. The distal end of the pouch may be free or attached by a fibrous strand to the internal aspect of the navel. At times it develops between the leaves of the mesentery or becomes adherent to the latter.

Such a diverticulum can form the content of a hernial sac, Littré's hernia. If inflammation occurs diverticulitis, peridiverticulitis, abscess and perforative peritonitis may result just as in the case of the vermiciform appendix. The accumulation of fecal material or the lodgement of foreign bodies or parasites within its lumen also predispose to infection and its consequences.

The mucosa of these various reported fistulas, cysts and diverticula usually resembled that lining the small intestine. A number of remarkable umbilical anomalies have been recorded, however, in which polyps, cysts and fistulas have secreted a fluid similar to gastric juice. When removed and examined histologically the mucosa bore a correspondingly close resemblance to that of gastric mucosa, usually of the antral type.

Gastric Mucosa at the Umbilicus.—In 1881 TILLMANNS¹ saw a boy of thirteen with a bright red umbilical tumor the size of a walnut covered by mucosa. It had been noted after the cord had separated and had gradually increased in size. It was attached by

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a thin pedicle. After the boy had eaten, the mucosa would become red and swollen and secrete abundantly. Mechanical stimulation had a similar effect, 2 to 3 cubic centimetres of cloudy tenacious fluid being collected in fifteen minutes. The fresh secretion was strongly acid in reaction and digested fibrin at 39° C. in an acid medium. (Prof. Drechsel.) When the tumor was removed it proved to consist of all layers of the stomach wall, the mucosa resembling that of the pyloric region. (Prof. Weigert.) The skin about the lesion had been eroded by the secretion from the tumor. Tillmanns believed the tumor resulted from a diverticulum of the stomach which presented in a small umbilical hernia and had become constricted off as a result of tying the cord too closely to the body of the infant.

VON ROSER² in 1886 saw a boy one and a half years old with a red granular tumor at the umbilicus. It presented a cavity one centimetre in diameter the fistulous opening into which was calloused. The secretion was acid and had macerated the surrounding skin. When excised its mucosa resembled that of the stomach. The peritoneum was not opened. A small residual tract 3 millimetres deep was destroyed with zinc chloride. The author ascribed the anomaly to a diverticulum of the stomach as did Tillmanns. A colleague had previously incised a cyst-like lesion at the navel and applied caustics several times.

SIEGENBEEK VAN HEUKELOM³ reported a case in 1888. A child two and a half years old had a red moist granular tumor at the umbilicus since the cord separated. Its short pedicle was divided, the bleeding being controlled by cautery. The tumor was covered by mucosa showing tubules with lymphadenoid and connective tissue interspersed, and resting upon a muscularis mucosae. The stalk contained smooth muscle, vessels and connective tissue. The mucosal glands contained no goblet cells. In the course of seeking for an explanation the author encountered a fetus with a Meckel's diverticulum the distal part of which was closed off from the main lumen. The mucosa of this portion resembled that of his operative case and of the pyloric mucosa of the same fetus. That of the patent part of the diverticulum was of the intestinal type. In young embryos the entodermal lining of the digestive tract is similar throughout. Differentiation does not occur according to this author until bile and pancreatic secretion enter the intestine. The closed-off portion of the Meckel's diverticulum not coming in contact with these secretions developed in a manner resembling the mucosa of the stomach. The author maintained that the theory of Tillmanns finds no corroboration in available facts.

VON ROSTHORN's case⁴ was reported in 1889. A boy of seven years had an umbilical fistula. After the cord had come away a finger-like projection 4 centimetres long appeared. Then an opening was found from which clear watery fluid flowed continuously. The protrusion gradually receded with the use of caustics, but the opening grew larger. Now a tumor of hazel nut size, red and glistening, presented at the navel. A small orifice admitted a probe for 2 centimetres. The skin about it was reddened. The secretion was mucoid, acid in reaction, and digested fibrin in an acid medium. It was rich in chlorides although free hydrochloric acid was not demonstrated. It amounted to 5 cubic centimetres in 24 hours. The excised funnel-like tract extended down to the peritoneum. At the bottom were glands resembling parotid acini, at the orifice was epidermis, the body of the tract presented a pylorus-like mucosa with deep branching glands.

The author ascribed the structure to the omphalomesenteric duct with early separation from the intestinal tract at a time when the mucosa had not become differentiated. He favored the theory of Van Heukelom and stated that there was no direct proof of the theory propounded by Tillmanns and von Roser.

WEBER⁵ saw a boy three years old who had a red growth at the navel since separation of the cord. There was now a fistula 1 centimetre deep. It secreted a watery mucoid fluid, at times with brownish flocculi, to an amount estimated as half a wineglassful a day. There was a colicky pain at midday. Recently a canal-shaped

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wound developed below the fistulous opening, gradually increasing in size, and its edges becoming indurated. This area was excised with the fistula and a cyst into which it led. A thin fibrous cord (remains of the umbilical vein) passed from the cyst to the under surface of the liver. There was no connection with the stomach or intestine. The mucosal lining of the cyst resembled that of the pyloric end of the stomach (Krause).

REICHARD'S case report⁶ is undoubtedly that of the same patient as Weber's.

LEXER's patient⁷ was a child of one year. It presented an umbilical fistula with erosion of the skin. The secretion was strongly acid and digested fibrin. A probe entered for 1.5 centimetres only, but at operation another tract led from this point for 6.5 centimetres and entered the small intestine. The distal portion opening on the surface was lined by mucosa resembling that of the pyloric end of the stomach. The proximal portion opening into the intestine was lined by intestinal mucosa. The author assumed an early severance of the outer from the inner portion of the persistent omphalomesenteric duct, thus confirming Siegenbeek's and von Rosthorn's contentions.

STRADA⁸ in 1903 reported the case of a woman, twenty years of age, who presented a pedunculated tumor, the size of a walnut, at the umbilicus. The removed specimen showed mucosa of the pyloric type, but some glands of the Lieberkühn type were also noted. An excellent critical study of the literature of the subject is included in this contribution.

MINELLI⁹ in 1905 described an adenoma of the umbilicus with the histology of gastric mucosa and also gave a thorough review of the subject.

DENUCE¹⁰'s patient was a boy twenty-one months of age, with a congenital umbilical fistula. It secreted a colorless or faintly blood-tinged fluid. The skin about it was ulcerated and indurated. A probe could be passed into the fistula for 1.5 centimetres. When the child ate, the flow from the fistula increased at once. Analysis of the secretion yielded free hydrochloric acid, albumin and peptone. Subsequent experiments proved the presence of pepsin and rennet.

At operation the tract was excised and from its base a cord could be seen passing to an intestinal loop. Histologically the mucosa was described as pyloric in type. The illustrations, however, show distinctly both chief and acid cells.

Comment.—Thus there was recorded the occurrence at the umbilicus of polypoid tumors, cysts and fistulas usually secreting an acid tenacious fluid, resembling gastric juice in its ability to digest fibrin and causing maceration, erosion or even chronic ulceration of the skin. Swelling and increased secretory activity of the mucosa were noted soon after the ingestion of food and after mechanical stimulation. These anomalous structures when removed and examined presented in whole or in part the histology of gastric mucosa of the type seen in the pyloric and antral regions. The lesions were observed in children, almost always males. Their rapid response to the introduction of food into the stomach is of great interest and suggests a reflex action through the nervous system. At first their origin was ascribed to some previous hernia or diverticulum of the stomach, but later the theory that they were remnants of the omphalomesenteric duct was suggested. As evidence in favor of the latter was Denucé's observation of a fibrous cord attached to an intestinal loop and Lexer's remarkable case of a patent Meckel's diverticulum underlying the umbilical fistula. Siegenbeek ascribed the gastric character of the mucosa to exclusion of part of the vitelline duct before bile and pancreatic secretions began to enter the bowel. Despite the fact that the secretion of the mucosa lining these cysts and fistulas or covering the umbilical polyps was usually acid in reaction, acid forming or oxyntic

cells were not noted. Denucé's illustration, however, shows acid cells. It is plausible to assume that the mucosa was usually of a primitive type, not completely differentiated, yet capable of producing both acid and ferment.

Gastric Mucosa in Meckel's Diverticulum, Associated with Peptic Ulcer of the Diverticulum or Ileum.—The theory of Siegenbeek van Heukelom, ascribing the presence of gastric mucosa to an early closing off of part of the vitelline duct, is contradicted by the report of a considerable number of instances subsequently recorded, in which gastric mucosa was found lining Meckel's diverticulum in whole or in part, despite the fact that there was free communication of the interior of the pouch with the lumen of the lower ileum. Schaetz¹¹ pointed out that islands of heterotopic gastric mucosa occur at two points in the embryonal gastro-intestinal tract, namely the oesophagus and the vitelline duct, the origin of the latter marking the division between the primitive fore and hind gut, and proposed the theory of embryonal transplantation. Later¹² he studied thirty specimens of Meckel's diverticulum by serial section. Of these only 17 or 57 per cent. were free of abnormal elements. Three, or 10 per cent., showed mucosa belonging to higher segments of the small gut, e.g., jejunum, duodenum (e.g., Brunner's glands and pancreatic tissue). Five cases, or 16.6 per cent. presented islands of gastric mucosa. One specimen contained pancreatic tissue, two others pancreatic tissue and gastric mucosa. Another showed a carcinoid, and the last a doubtful type of heterotopia. The incidence of Meckel's diverticulum according to the statistics of various authors ranges from 1 to 4 per cent. According to Stern,¹³ Hilgenreiner stated that it occurred once in sixty-one females as against once in thirty-nine males; Doeppfner found one in 214 females as against 102 males. Thus it appears to be twice as frequent in males as in females.

The following cases called our attention to the subject of gastric heterotopia in Meckel's diverticulum and led to a review of the literature on the subject.

CASE I.—(Mt. Sinai Hospital No. 293095.) A female infant of fifteen months became suddenly pallid and vomited three days before admission. For two days thereafter she was restless, sleepless, irritable and had temperature of 101° F. On the day of admission foul clotted blood was passed with the stool and she was referred to the hospital by Dr. David Maeth with the diagnosis of Meckel's diverticulum. The patient was pale, with haemoglobin 55 per cent. General condition was good. A tender mass about 4 centimetres in diameter was felt in the lower abdomen to the right of the mid-line. Per rectum an irregular papillary mass could be felt high up on the right side suggesting an intratestinal growth. Two hours later the rectal examination revealed a sausage-like protrusion with a central depression simulating the cervical os and the possibility of an intussusception made surgical intervention advisable.

Operation July 24, 1928 (P.W.A.) Under ether anaesthesia a right rectus incision was made. A firm thickened inflamed diverticulum was found about 4 centimetres long attached by a fibrous strand to the umbilical region. Beneath this passed a loop of ileum. The mesentery of the terminal ileum was inflamed with areas of gangrenous exudate at the site of adhesions between loops of gut. There was extensive enlargement of the mesenteric lymph nodes. No intussusception was found.

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The diverticulum was freed from the abdominal wall and the adherent loops of gut separated. An ileostomy of the Witzel type was made about six inches above the origin of the diverticulum. A lymph node was removed from the mesentery for examination to exclude lymphosarcoma. Wound closed in layers.

Post-operative course.—The enterostomy functioned well. A transfusion was given the next day bringing the haemoglobin up from 35 to 66 per cent. On the second day old blood was passed per rectum. The lymph node was reported as simple hyperplasia. Enterostomy tube removed on eighth day. Wound healed completely on thirteenth day. The mass palpable before operation could no longer be felt. It was, therefore, felt that the process was inflammatory and that the diverticulum should be resected.

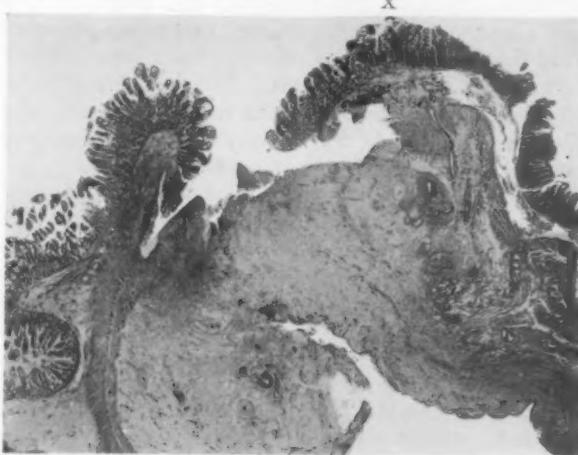


FIG. 1.—Microphotograph showing penetrating ulcer of the ileum close to the adjoining gastric mucosa of the Meckel's diverticulum.



FIG. 2.—Microphotograph showing the transition between mucosa of intestinal and gastric types. This area corresponds to that marked X in Fig. 1.

was situated entirely in mucosa of intestinal type, mucosa of the diverticulum. (Figs. 1 and 2.)

Operation August 10, 1928 (P.W.A.). Under ether anaesthesia the abdomen was reopened through the old scar. The ileocecal junction was identified and the ileum followed proximally to the diverticulum which was found much smaller and less inflamed. It was adherent, however, to the under surface of the mesentery and in separating it from the latter, a small opening in the bowel at the origin of the pouch was found. The diverticulum was now resected with an elliptical portion of the free border of the ileum. The intestine was closed in two layers at right angles to the line of the excision so as to prevent stenosis. The abdomen was closed in layers without drainage. The wound healed well and convalescence was uneventful.

The diverticulum was lined throughout by gastric mucosa showing both chief and acid cells. In the portion of excised ileum just beyond the neck of the pouch was a small chronic penetrating ulcer showing the features commonly found in active peptic ulcer. It was situated entirely in mucosa of intestinal type, mucosa of the diverticulum.

It was then recalled by one of us (K) that a similar case had been observed on the pediatric service two years previously.

CASE II.—(Mt. Sinai Hospital No. 262864.) A baby boy of twenty-six months was admitted January 6, 1926, for hemorrhage from the bowel. The infant had been admitted on four previous occasions for the same complaint. The first admission was at the age of seventeen months. On one admission the hemoglobin was 30 per cent. and transfusion was necessary. The last admission was a month ago, when a sausage-shaped mass was felt in the right lower quadrant, but disappeared the next day. Gastrointestinal X-ray studies proved negative.

Two months before the present admission the child suffered abdominal pain in the umbilical area, vomited and passed bright red blood per rectum. The temperature was 101° F. The hemoglobin was 63 per cent. There was some resistance and tenderness in the right lower quadrant. Chronic or recurring intussusception was suspected.

Operation January 11, 1926.—(Dr. A. V. Moschcowitz). A Meckel's diverticulum was found eighteen inches above the ileocecal valve. It was red, inflamed and indurated down to the base. The diverticulum was excised, the stump carbolized and inverted.

On reexamining the specimen removed, a remarkable similarity to that obtained in Case I was observed. A peptic ulcer was present at the base or neck of the diverticulum at the junction of intestinal and gastric types of mucous membrane.

The cases reported in the literature are summarized in Tables I and II. In the first group are 21 instances in which gastric mucosa was demonstrated in the diverticulum by microscopic examination. The second group consists of 12 cases in which the mucosal histology was not investigated, but in which an ulcer was found upon inspection of the gross specimen. The clinical histories and operative or autopsy findings in the latter series resemble the former in every respect. It therefore seems warranted to consider them together.

Etiology and Pathology.—The ages of the patients ranged from nine months to forty-five years, but infants and children comprised three fourths of the cases. The sex incidence was as follows: four females, twenty-eight males, one not specified. It has already been noted that Meckel's diverticulum occurs twice as often in males as in females. Peptic ulcer of the diverticulum or adjoining ileum, however, is seven times more frequent in males. The sex incidence, therefore, approximates that of duodenal ulcer.

The ulcers were usually chronic in type, penetrating or perforating, and resembled the peptic ulcers of the stomach and duodenum. They presented a superficial area of necrotic tissue and exudate, a zone of granulation tissue, and a denser more organized substratum beneath which was the disrupted muscularis and the thickened serosa. One acute punched-out perforated ulcer was observed,—and one which had undergone almost complete healing. Of the thirty-three ulcers seventeen, or almost 50 per cent., had perforated either into the free peritoneal cavity with resulting generalized peritonitis, or had penetrated more slowly with resulting sealing off and local peritonitis. Eroded arteries were noted in five cases. Extensive mesenteric lymphadenopathy was found in three.

It is remarkable that the ulcer was usually situated at the neck of the diverticulum or in the ileum just beyond its neck. In these cases the entire pouch was lined by gastric mucosa, both chief and acid cells being noted

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by five of the authors. The analogy to duodenal ulcer and gastrojejunal ulcer is striking. In those instances in which the lesion was located near the tip or in the body of the pouch histologic study showed the ulceration to have occurred in mucosa of intestinal type adjoining a patch of heterotopic gastric mucosa. This finding lends support to those who contend that peptic ulcer in the stomach occurs in islands of heterotopic intestinal mucosa situated in the gastric mucosal lining.

That the heterotopic gastric mucosa in these cases secreted free hydrochloric acid and pepsin may be assumed from the fact that such secretion with attendant irritation and ulceration of the surrounding skin has been amply demonstrated in recorded cases of heterotopic gastric mucosa occurring in umbilical polyps and fistulas.

Symptomatology and Diagnosis.—The most common symptom of this disease was the passage of fresh blood and clots per rectum. It was absent in only five of the thirty-three cases reported, and in one of these anaemia was noted. The haemorrhages were often brisk with long periods of intermission. In Hilgenreiner's patient, who was eighteen years old, blood had been noted in the stools at intervals since childhood. Hübschmann's patient had bleeding following a slight trauma to the abdomen. The infant observed by Callender died thirty-six hours after the onset of haemorrhage. The man of twenty-eight reported by Mégevaud and Dunant had repeated haemorrhages since childhood. This presenting symptom led to the diagnosis of intestinal ulcer, tuberculosis, tumor or polyp, duodenal ulcer.

In some cases central abdominal pain preceded the attacks of bleeding, in others it followed the accident. Pain of some sort was noted in twenty-one cases. It was described as cramps, colicky, gnawing. In Mégevaud's patient it was cyclic, relieved by food. In Hübschman's the clinical symptoms suggested peptic ulcer. In Kleinschmidt's case it occurred regularly one and one-half hours after meals. In many its onset was coincidental with the beginning of perforation.

Sudden perforation and the signs of peritonitis were frequent, and these cases were diagnosed as perforative peritonitis, acute appendicitis, ileus. This was the clinical picture in eleven instances, one-third of the total number.

A palpable mass was observed in only one instance beside the two which we have reported. This finding together with the passage of blood per rectum immediately suggested intussusception. The stools lacked the usual admixture of mucus and the symptoms of obstruction were wanting. The differential is extremely difficult, however.

The case reported by A. S. Jackson was diagnosed by the family physician Dr. A. Ketterer, who had seen a similar case ten years previously. The latter had been operated upon by R. H. Jackson. Doctor Maeth diagnosed Meckel's diverticulum in one of our own cases.

Gastro-intestinal X-ray studies were made in six cases without giving any helpful information.

Exploratory laparotomy will usually be the only means of establishing

the diagnosis when, in the presence of suggestive symptoms, other lesions of the gastrointestinal tract have been excluded as the cause of the bleeding by X-ray and sigmoidoscopy.

Treatment.—Unexplained cases of repeated intestinal haemorrhages, in which other lesions have been excluded, should be subjected to exploratory laparotomy on the presumptive diagnosis of peptic ulcer in association with Meckel's diverticulum. If the lesion is found the operation of choice is excision of the diverticulum with enterorrhaphy at right angles to the long

TABLE I
Gastric Mucosa in Meckel's diverticulum with peptic ulcer

Author	Age	Sex	Intestinal Haemorrhages	Pain	Mass	"Acute" Abdomen	Preoperative Diagnosis	Findings	Result
Hilgenreiner	18	M	+	+	+			Ulcer in M.D. adherent to parietes	Well
Deetz	9	M				+	Perforated appendicitis	Perforated ulcer at base of M.D.	Well
Hübchmann	4½	M	+			+	Peritonitis (Autopsy)	Perforated ulcer, marginal	Ceased
Callender	19 mos.		+					Ulcer in ileum; open vessel at margin	Ceased
Gramen	10	M		+		+	Appendicitis (Autopsy)	Perforated ulcer	Well
Meulengracht	12	M	+	+			Peritonitis	Ulcer about to perforate	Ceased
Müller	11	M	+	+		+	Duodenal ulcer; intestinal tumor	Perforated ulcer	Well
Megevaud and	28	M	+	+			Peritonitis	Marginal ulcer; eroded artery	Well
Durant									
Humbert	11 mos.	M	+			+	Peritonitis	Perforated ulcer of M.D.	Ceased
Brasser	15	M	+	+		+	Intestinal polyp	Perforated marginal ulcer	Ceased
Guibal	14	M	+				Intestinal TBC	Chronic penetrating marginal ulcer; eroded vessels	Well
Pascale	41	M	+	+			Ulcus intestinalis	Ulcer of M.D.	Well
Ulrich	8 mos.	M	+			+	Peritonitis	Perforated M.D.; mesenteric adenitis	Ceased
Abt and Strauss, Case 1	20 mos.	F	+	+			?	Ulcerated M.D.	
Kleinschmidt	15	M	+	+		+	Appendicitis	Perforated ulcer near base	Well
Jackson, A. S.	14	M	+	+			Peptic ulcer of M.D.	Ulcer in M.D.	Well
McCalla	46 mos.	M	+	+			(Autopsy)	Marginal ulcer	Ceased
Hartglass	4	F					Peritonitis	Perforated ulcer, at base	Well
Peterman and See- ger	6	M	+	+		+	Appendicitis	Penetrating ulcer; many ulcerations in ileum	Well
Aschner and Karelitz, Case 1	15 mos.	F	+		+		Tumor	Penetrating marginal ulcer; mesenteric adenitis	Well
Do., Case 2	26 mos.	M	+	+	+		Intussusception	Peptic ulcer; diverticulitis	Well

axis of the ileum. The excision may have to include a considerable margin of the wall of the ileum when the ulcer is situated either in that structure or at the neck of the diverticulum. In occasional cases the inflammatory involvement may be so extensive as to necessitate resection of a considerable segment of the ileum with end to end anastomosis. It is probable that this radical procedure can be avoided if an ileostomy is performed proximal to the diverticulum, which may be excised subsequently when the inflammatory process has subsided.

Summary.—Heterotopic gastric mucosa has been shown to occur at the umbilicus as a result of anomalous developmental structures arising from the omphalomesenteric duct. Such areas of mucosa have been demonstrated

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to produce a secretion containing free hydrochloric acid and pepsin with irritation, erosion and ulceration of the surrounding skin. The secretion could be excited by the ingestion of food or by local mechanical stimuli. Heterotopic gastric mucosa has also been demonstrated in Meckel's diverticula which have retained their connection with the lumen of the ileum. Chronic ulcers causing pain, haemorrhage and perforation, and histologically identical with peptic ulcer of the stomach, duodenum and jejunum have been described in Meckel's diverticulum and the ileum (thirty-three cases). In twenty-one of these cases gastric mucosa was demonstrated in the diverticulum. The ulcers occurred in the intestinal type of mucosa adjoining the heterotopic gastric mucosa, being most frequently located at the neck of the

TABLE II

Probable peptic ulcer of Meckel's diverticulum, mucosa not investigated

Author	Age	Sex	Intestinal Hemorrhages	Pain	Mass	"Acute Abdomen"	Preoperative Diagnosis	Findings	Result
Denneke Läwen	7 23	M M		+		+	Appendicitis Peritonitis (Autopsy)	Perforated ulcer at base Perforated ulcer; spurring artery Ulcer of M.D.; peridiverticular abscess; mesenteric adenitis	Ceased Well
Griffith	19 mos.	M	+	+			Peritonitis ?	Perforated M.D. Marginal ulcer; eroded artery	Ceased
Brentano Jackson, R. H.	21 10	M M	+	+		+	Ileus peritonitis (Autopsy)	Perforated marginal ulcer Perforated ulcer at base; abscess	Well Well
Stulz and Wöringer, Case 1 Do., Case 2	4 11 mos.	M M	+	+			?	Ulcerations at tip	Ceased Ceased
Abt and Strauss, Case 2	11 mos.	M	+	+					Well
Moore, Case 1 Do., Case 2	4 9 mos.	M M	+	+				Ulcer at base Necrotic bleeding ulcer	Well Well
Puss Kleinschmidt, Case 2	37 45	F M	+	+				Perforated ulcer	Well

diverticulum which was usually completely lined by gastric mucosa. The occurrence of this type of lesion lends strong support to the theory that the free hydrochloric acid secreted by the gastric mucosa is the most important activating factor in the etiology of peptic ulcer. The cure of these patients by resection of the diverticulum, thus removing the acid secreting gastric type of mucosa, further encourages the efforts of modern surgery to eliminate the factor of free hydrochloric acid in the therapy of peptic ulcer of the stomach, duodenum and jejunum.

BIBLIOGRAPHY

Gastric Mucosa at the Umbilicus

1. Tillmanns, H.: Deutsch. Ztschr. f. Chir.....1882-3, 18, 161
2. von Roser, W.: Centralbl. f. Chir.....1887, 14, 260
3. Siegenbeek von Heukelom: Virchow's Archiv.....1888, 111, 475
4. von Rosthorn, A.: Wien, Klin. Wchnschr.....1889, 2, 125, 154
5. Weber, W.: Beitr. z. Klin. Chir.....1898, 22, 371

ASCHNER AND KARELITZ

- | | |
|--|---------------|
| 6. Reichard: Centralblatt f. Chir..... | 1898, 25, 587 |
| 7. Lexer, E.: Arch. f. Klin. Chir..... | 1899, 59, 859 |
| 8. Strada, F.: Lo sperimentale Archiv. di biol norm e patol..... | 1903, 57, 637 |
| 9. Minelli, S.: Gaz. Med. Italian..... | 1905, 56, 101 |
| 10. Denué: Rev. d'orthoped..... | 1908, 19, 1 |

Gastric Mucosa in Meckel's Diverticulum

- | | |
|--|--------------------|
| 11. Schaetz, G.: Virchow Archiv..... | 1923, 241, 148 |
| 12. Schaetz, G.: Ziegler's Beiträge..... | 1925, 74, 115, 225 |
| 13. Stern: Deut. Ztschr. f. Chir..... | 1917, 140, 343 |

Peptic Ulcer in Meckel's Diverticulum and Ileum

- | | |
|---|-----------------|
| 14. Hilgenreiner: Beitr. z. Klin. Chir..... | 1903, 40, 99 |
| 15. Deetz: Deut Ztschr. f. Chir..... | 1907, 88, 482 |
| 16. Hübschmann: Munch Med. Wchnschr..... | 1913, 2051 |
| 17. Callender: Am. Jour. Med. Sci..... | 1915, 150, 68 |
| 18. Gramen: Norsk Med. Arkiv..... | 1915, 48, No. 9 |
| 19. Meulengracht: Virchow Archiv..... | 1918, 225, 125 |
| 20. Muller: Beitr. z. Klin. Chir..... | 1919, 115, 560 |
| 21. Mégevaud and Dunant: Rev. de Chir..... | 1922, 60, 536 |
| 22. Humbert: Paris Thesis..... | 1924, No. 395 |
| 23. Brassier: Centrabl. f. Chir..... | 1924, 51, 2423 |
| 24. Guibal: Bull et mem de la Soc. Nat. de Chir..... | 1924, 50, 349 |
| 25. Pascale: Annal Ital di Chir..... | 1925, 4, 965 |
| 26. Ulrich: Ugeskrift. f. Laeger..... | 1925, 87, 664 |
| 27. Abt and Strauss: Jour. Am. Med. Assn..... | 1926, 87, 991 |
| 28. Kleinschmidt: Beitr. z. Klin Chir..... | 1926, 138, 715 |
| 29. Jackson, A. S.: ANNALS OF SURGERY..... | 1927, 85, 252 |
| 30. McCalla: Canad Med. Jour..... | 1927, 17, 79 |
| 31. Hartglass: Bull et mem de la Soc. Nat de Chir..... | 1928, 54, 1091 |
| 32. Peterman and Seeger: Am. Jour. Dis. Child..... | 1928, 36, 515 |
| 33. Denneke: Deut. Ztschr. f. Chir..... | 1903, 62, 523 |
| 34. Läwen: Münch Med. Wchnschr..... | 1909, 56, 478 |
| 35. Griffith: Trans. Am. Ped. Soc..... | 1914, 26, 211 |
| 36. Brentano: Sitzungsprotokoll, Freie Vereing der Chir., Berlin..... | 1904, 3, 4 |
| 37. Jackson, R. H.: ANNALS OF SURGERY..... | 1924, 80, 222 |
| 38. Stulz and Wöringer: ANNALS OF SURGERY..... | 1926, 83, 470 |
| 39. Fuss: Deut. Ztschr. f. Chir..... | 1926, 109, 236 |

Meckel's Diverticulum, Hemorrhage, Ulcer Not Noted

- | | |
|---|---------------|
| 40. Abt. and Strauss: Case III, Loc. cit. | |
| 41. Stone, J. B.: Discussion of same. | |
| 42. Mayo and Johnson: Surg. Clin. of North America..... | 1926, 6, 1127 |
| 43. Drummond: ANNALS OF SURGERY..... | 1912, 55, 404 |
| 44. Stern: Case I, Loc. cit. | |

Miscellaneous References

- | | |
|--|----------------|
| 45. Ansart: Progresso d. I. Clinica..... | 1927, 35, 10 |
| 46. Eckhoff: Guy's Hosp. Reports..... | 1926, 76, 429 |
| 47. Gebele: Münch Med. Wchnschr..... | 1908, 55, 1236 |
| 48. Stones, E.: Surg. Gyn. Obst..... | 1923, 37, 51 |
| 49. Tisdall: Am. Jour. Dis. Child..... | 1928, 36, 1219 |

MULTIPLE CARCINOMATA OF THE LARGE INTESTINE*

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THERE has been controversy as to whether or not carcinoma of the large intestine is preceded by adenomatous polyp. For those who believe that this relationship does exist, cases of multiple carcinoma of the large intestine can be divided into those which develop on the basis of polyposis and those which do not. The existence of multiple carcinoma of the former type of origin is well known, although cases of multiple carcinoma of the colon have been reported in which it seems that the authors have not recognized the fact that polyposis had preceded the carcinoma. Thus, Phillips and Macbeth reported a case of diffuse adenocarcinoma of the colon in which, judging from the history, a condition of multiple polyposis had existed previously. In the report we are about to make we are not concerned with cases in which multiple polyposis preceded the carcinomas.

The cases which we wish to report are of a type that is not common or well recognized. In all, there was more than one carcinoma of the colon, each of independent origin.

The importance of the investigation is fourfold: (1) The infrequency with which multiple primary malignant lesions of the large intestine are recognized, exclusive of those which are preceded by polyposis, has been mentioned; (2) the possibility of multiplicity of lesions has an important bearing on prognosis; (3) if the possibility of multiplicity of lesions were borne in mind the treatment of so-called benign single polyp might be modified in some cases, and (4) the study might serve as a stimulus to the development of better means of investigation of lesions of the colon.

In attempting to evaluate our own work we have reviewed the reports and opinions of previous investigators. We shall mention a few of them.

Christian Fenger, in 1888, reported a case of double carcinoma of the colon before the Chicago Gynecological Society in which he had performed colostomy for obstructing carcinoma of the colon. The patient's condition was not relieved, and necropsy revealed that there was a carcinoma of the ascending colon and one of the splenic flexure, both large and obstructive. The colostomy had been made between the two obstructive lesions. They were thought to be distinct and separate carcinomas.

In the forty-one years which have elapsed since then, few similar cases have been recorded. However, the occurrence of more than one primary malignant lesion, at the same time or at widely separated intervals, in the same patient, has been frequently noted.

Major, in 1918, reported a case of carcinoma of the face and sarcoma of the stomach and reviewed the literature on multiple malignant lesions

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occurring in the same patient. In this way he noted 196 different combinations of malignant lesions in as many patients, recorded by 196 authors. Major's review of the literature on that subject is the most complete one which we have found. The 196 cases occurred between the years 1889 and 1918. Major noted that with certain kinds of tumors, multiplicity of lesions was prone to occur. In this review of a rather large number of cases not a single instance of more than one tumor in a colon occurred. However, Dowden reported a case in 1917 of a patient who had four lesions of the colon, all within six years. In a series of seven cases of primary malignant lesions in widely separated parts of the body, Ellsworth found two, each with two carcinomas of the colon. He felt that the evidence was clearly in favor of two independent new growths and not of metastasis. Miller reported five cases, in three of which there seemed undoubted development of two or more primary carcinomas of the colon. The three cases included the following: In one case there were three lesions; one of the ileum, one of the cæcum and one of the sigmoid; the first two were annular and the third was polypoid. In the second case a carcinoma of the rectum occurred, and eight years later, a carcinoma of the hepatic flexure. The third case was of two separate annular lesions of the sigmoid of different types. The other two cases might have been examples of recurrence but so much time elapsed between the first and second tumors that they might, also, have been independent growths.

These reports leave little doubt but that multiple primary malignant lesions actually occur not only in the same patient but in the same organ.

One of us (Rankin), in reviewing large numbers of cases, stated that the incidence of multiple carcinoma was very small. In relation to this statement it is recalled that Billroth laid down three postulates which should be fulfilled before multiple carcinomas can be identified as independent lesions: (1) The two growths must show distinct histologic differences which must be so pronounced as to exclude the possibility that they are of the same origin, but in different stages of development; (2) each growth must spring from its parent epithelium, and (3) each growth must be held responsible for its own group of metastatic growths. Attention is also called to Mercanton's addition to these three postulates; that is, "If after removal of two carcinomas the patient remains free from disease, the two growths must have been independent else there should have been other metastasis." It is evident that when growths from intestinal epithelium are concerned, the first of Billroth's postulates cannot well be fulfilled. Moreover, since carcinomatous degeneration of separate intestinal polyps is entirely likely, it seems that this postulate need not be fulfilled in identifying multiple, independent carcinomas of the intestine.

Cabot reported a case in which carcinoma of the cæcum was followed ten years later by carcinoma of the splenic flexure. The appearance of two lesions so widely separated in time, with good health in the interval, should be an indication of two new growths. Ewing, in the chapter on metastasis

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in his 1928 edition of "Neoplastic diseases" made this appropriate statement: "We do not speak of recurring uterine myomas, for these are clearly multiple, so why not carcinoma and sarcoma?"

CASE I.—A woman, aged sixty-four years, came to the clinic December 10, 1924, complaining of extreme fatigue and pallor, which had begun about a year before admission. She stated that she always had had a "delicate stomach," had vomited easily, and up to fifteen years before admission she had had diarrhoea every autumn, occasionally with bloody streaking of the stools. Although the diarrhoea had not been a marked feature in the last fifteen years, the stools had always been loose.

Proctoscopic examination revealed a carcinoma measuring 6 by 6 by 8 centimetres, situated in the posterior rectal wall. Röntgenograms of the colon after barium enema disclosed obstruction at the hepatic flexure.

At exploration, December 22, a lymph node was removed from the mesentery which proved to be the site of colloid carcinoma. There was a tumor about 8 centimetres in diameter in the ascending colon. Because of the metastasis, the size of the lesion, and the patient's general condition, ileocolostomy was made.

CASE II.—A man, aged fifty-five years, had come to the clinic in August, 1923, at which time a diagnosis of syphilis of the central nervous system and tabes dorsalis had been made. For these conditions he had had extensive treatment. He returned, April 24, 1925, for reexamination and because he had felt a lump in the abdomen which was movable and which would appear and disappear. He had first noticed this about a year before his second visit. He had consulted numerous physicians about it and all, he said, had advised against exploration. Constipation had increased until a month before admission, since which time he had had loose stools. He had lost twenty-six pounds in weight. He had not seen blood in the stools.

Proctoscopic examination disclosed a carcinoma on the anterior rectal wall. Because of the movable mass in the right lower quadrant of the abdomen röntgenologic examination of the colon was undertaken. This disclosed a filling defect in the cæcum.

Exploration was undertaken, May 25, 1925, at which time carcinoma of the cæcum, with chronic intussusception of the ascending colon, was found. Right hemicolectomy was performed and lateral anastomosis was made between the lower part of the ileum and the transverse colon. Pathologists reported an adenocarcinoma of the cæcum measuring 8 by 6 by 3 centimetres, with serosal and lymphatic involvement. September 21, 1925, the local rectal lesion was excised; this was reported by the pathologist to be adenocarcinoma graded 2. The patient died, July 7, 1926, at his home, apparently from recurrence.

CASE III.—A man, aged sixty-eight years, came to the clinic, July 26, 1927, complaining of rectal bleeding of one and a half year's duration. He had lost about 5 pounds in weight. Proctoscopic examination revealed a normal rectal mucosa for 24 centimetres. Röntgenogram after barium enema disclosed a filling defect in the sigmoid portion of the colon.

Exploration, August 5, 1927, revealed a malignant polyp of the descending colon, at which time the first stage of the Mikulicz operation was done. Subsequently, the second stage was done. Pathologists found two distinct malignant lesions, one of which measured 5 by 3 by 1 centimetres, and an adenocarcinoma graded 2, without lymphatic involvement. The second tumor, 5 centimetres above the first, was an adenocarcinoma graded 1 and measured 5 centimetres in diameter.

CASE IV.—A man, aged fifty-three years, came to the clinic in May, 1922, complaining of pain and distress across the lower part of the abdomen, of eighteen months' duration, and coming at intervals of three to seven days. In several of the attacks there had been emesis, but never fever. The family history was noteworthy. The mother had died of what was said to have been carcinoma of the liver. One brother had died

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of intestinal obstruction and one brother had a tumor of the transverse colon. The patient had undergone appendectomy elsewhere than at the clinic and adhesions about the colon had been dissected away. About three weeks after the operation, the attacks had recurred. In September, 1920, he had weighed 210 pounds; in May, 1921, 140 pounds. Later on, his weight had increased to 196 pounds. On admission to the clinic he weighed 165 pounds. He never had had diarrhoea; there never had been gross blood in the stools and constipation had been present all his life.

General examination disclosed the presence of a movable mass in the lower right quadrant of the abdomen. A röntgenogram of the colon disclosed a filling defect in the cæcum and proximal part of the transverse colon (Fig. 1). The concentration of haemoglobin was 60 per cent.; erythrocytes numbered 4,170,000 and leucocytes 11,700 in each cubic millimetre of blood. Exploration was undertaken and two carcinomas were found, one of the cæcum, and one of the proximal portion of the transverse colon, for which right end-to-side anastomosis and right resection were done. The pathologist



FIG. 1.—Case IV. Filling defect in cæcum and proximal part of transverse colon.

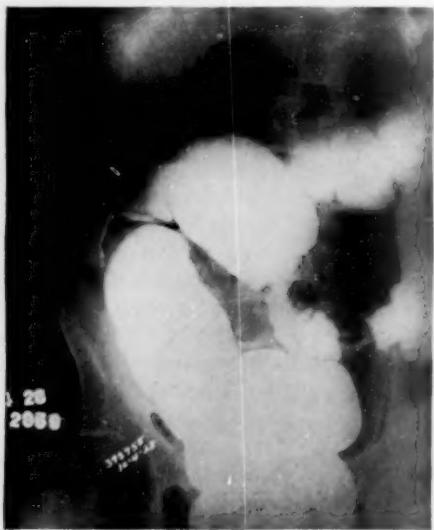


FIG. 2.—Case IV. Later filling defect in sigmoid portion of colon.

reported carcinoma of the cæcum, 5 centimetres in diameter, and carcinoma of the transverse colon, 1 centimetre in diameter, with lymphatic involvement.

The patient returned in October, 1928, with the statement that constipation had continued since the operation, that it had become much worse during the last year, and that it had been extremely difficult for him to move his bowels three months prior to readmission. For six months there had been pain and aching in the lower part of the abdomen, which was worse when he stood erect. Often, it was of the tearing type. During the three months prior to his second admission he had been taking a considerable quantity of laxatives, and three weeks prior to admission, very severe, continuous pain had developed in the right lumbar region, with intermittent attacks of greater severity. He had lost thirty-five pounds in five months prior to admission. Examination revealed a mass in the left lower quadrant of the abdomen. A röntgenogram of the colon disclosed two filling defects, one in the sigmoid, and one in the distal part of the transverse colon (Fig. 2). Exploration was undertaken, October 18, and two carcinomas, one of the sigmoid, and one of the transverse colon, were found. The one in the transverse colon, near the splenic flexure, was polypoid and mobile. The one in the sigmoid, however, was fixed to the tissue about it and to the pelvic rim, and had in it several loops of small bowel, so that it was clearly inoperable. Colostomy of the transverse

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colon was made. A third brother of this patient presented himself at the clinic in the summer of 1929 with carcinoma of the transverse colon.

CASE V.—A man, aged fifty-three years, came to the clinic, in June, 1920, stating that he had been well until two years prior to his admission, since which time he had had epigastric distress. The distress had come on every day several hours after eating. There had been progressive loss of strength and progressive pallor, and he had noticed a mass in the right lower quadrant of the abdomen. He had lost thirty-three pounds in weight. The concentration of haemoglobin in the blood, on admission, was 21 per cent, with 2,690,000 erythrocytes and 13,200 leucocytes for each cubic millimetre of blood. There was a freely movable mass in the abdomen, to the right of the umbilicus. After several transfusions, exploration was undertaken and a carcinoma of the ileocecal coil was found. Resection of the right half of the colon and end-to-end anastomosis was done. The pathologist reported a carcinoma of the ascending colon which measured 10 by 6 by 2.5 centimetres without lymphatic involvement.



FIG. 3.—Case VI. Filling defect of ascending colon in 1920.

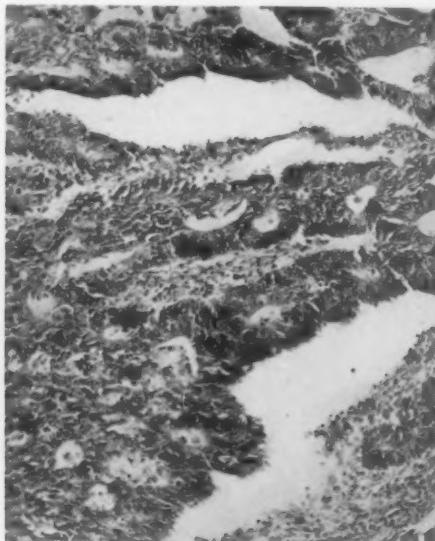


FIG. 4.—Case VI. Microscopic structure of the carcinoma resected in 1920.

The patient returned for observation in November, 1924, without any complaints and nothing unusual was found on general examination. He returned also in October, 1926, without any complaints. A röntgenogram of the colon at that time disclosed some spasm in the descending colon. In October, 1927, he was brought to the hospital with partial intestinal obstruction. He stated that a week prior to admission there had been some difficulty in moving the bowels but that only twenty-four hours before admission there had been the severe gripping pains, abdominal distention, and difficulty in moving the bowels. After the obstruction had been reduced, röntgenologic examination of the colon was undertaken and a filling defect of the upper part of the sigmoid was noted. Exploration was done, and a ring type of carcinoma of the sigmoid was found, for which a Mikulicz type of operation was done. Metastasis was not found in the abdomen. The pathologist reported adenocarcinoma, 5 by 5 by 1 centimetres, without lymphatic involvement.

When the patient was last examined, in September, 1929, he was the picture of health. There was no evidence of recurrence and the blood count was normal. The patient weighed 15 pounds more than his usual normal weight.

CASE VI.—A woman, aged thirty-seven years, came to the clinic, March 9, 1920, stating that following a cold in November, 1919, a dull pain had developed in the

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lower right quadrant of the abdomen. Since that time, there had been some distress from gas and an intermittent fever with a temperature often as high as 102° F. The fever had lasted for a week and this had been followed by a week of freedom from it. Constipation had been present for ten years, but there never had been diarrhoea or gross blood in the stools. In February, 1920, röntgenograms of the colon made elsewhere than at the clinic had suggested obstruction in the ascending colon. A cystoscopic examination at this time gave negative results. During the three months prior to admission to the clinic, she had noticed considerable gurgling of gas in the right side of the abdomen which seemed to come to a certain spot and stop. She had lost nineteen pounds in weight.

Examination at the clinic revealed a movable, rather firm mass in the right side of the abdomen. In the röntgenograms, a filling defect of the ascending colon was seen (Fig. 3). The concentration of haemoglobin at this time was 60 per cent.; erythrocytes numbered 4,150,000 and leucocytes 11,800 in each cubic millimetre of blood. Exploration,



FIG. 5.—Case VI. Filling defect in sigmoid portion of colon in 1926.



FIG. 6.—Case VI. Microscopic structure of the carcinoma resected in 1926.

March 13, revealed a carcinoma of the ascending colon and hepatic flexure for which resection of the right half of the colon and end-to-end anastomosis were done. The surgeon expressed the prognosis as a "50 per cent. chance of a five-year cure." The microscopic appearance of this tumor is shown in Fig. 4.

The patient returned for observation in October, 1922. She had gained thirty-four pounds in weight. The concentration of haemoglobin at this time was 75 per cent. and erythrocytes numbered 4,210,000 in each cubic millimetre of blood. Röntgenograms of the stomach and colon gave negative results and there was no evidence of recurrence of the malignant condition.

On the patient's next visit in August, 1926, she stated that there had been some rectal bleeding since 1922. Abdominal gas and discomfort had started in 1925 and there had been much bloating three months prior to admission. She then had had the first attack of severe cramp in the lower part of the abdomen, which had been relieved by passage of gas. This had recurred at frequent intervals. She had lost twenty-two pounds in weight and a mass low in the left side of the abdomen was felt on pelvic examination. The concentration of haemoglobin at this time was 54 per cent., and

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erythrocytes numbered 3,570,000 in each cubic millimetre of blood. The röntgenogram of the colon disclosed a filling defect in the sigmoid (Fig. 5).

Exploration, September 3, revealed a carcinoma of the sigmoid for which a first and second stage Mikulicz operation was done. The pathologist reported colloid adenocarcinoma graded 1 (Fig. 6). The final stage of the Mikulicz operation was performed November 11.

The patient returned for examination in April, 1929. She stated that she had been very well since the operation of 1926 but that there had been some distress in the region of the scar, and during the week prior to her admission there had been generalized abdominal cramps. She had had intermittent bloating, abdominal distention and progressive difficulty in movement of the bowels for the four months prior to admission. Also, there had been much abdominal gurgling, and she described visible peristalsis running from the right side of the abdomen toward the umbilicus.

Examination disclosed visible peristaltic waves, and a movable mass in the region of the splenic flexure above the scar of the Mikulicz operation. The mass moved with respiration. Röntgenograms, April 11, showed an extensive filling defect of the splenic flexure of the colon (Fig. 7). The concentration of haemoglobin at this time was estimated at 55 per cent.; erythrocytes numbered 3,810,000 and leucocytes 14,300 in each cubic millimetre of blood.

Exploration, April 19, revealed a carcinoma, for which resection of the left half of the transverse colon, splenic flexure and descending colon was made and colostomy was done. The pathologist reported carcinoma, 5 centimetres in diameter, with lymphatic involvement (Fig. 8). At the visits, in 1920, 1926, and 1929, proctoscopic examination gave negative results.

The patient returned, October 14, 1929, stating that for three months after the last operation she had steadily improved in health but that during the last three months she had failed progressively, had been weaker and had felt a tumor in the lower part of the abdomen. At this time the concentration of haemoglobin was 40 per cent. The patient looked ill and there was a huge mass in the lower part of the right side of the abdomen, very mobile and globular. A probable diagnosis of recurrent, metastatic carcinoma was made, and because of the mobility of the region, exploration was undertaken.

October 21, subtotal abdominal hysterectomy was done for a huge sarcoma of the uterus. The pathologist reported degenerating sarcoma of the uterus measuring 15



FIG. 7.—Case VI. Filling defect in splenic flexure of colon in 1929.

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by 14 by 13 centimetres, with adnexa, weighing 780 grams. The patient recovered and was living and doing fairly well, December 1, 1929.

CASE VII.—A man, aged fifty-six years, came to the clinic, May 19, 1926, complaining of increasing constipation during the year prior to his admission. Blood in the stools, and brownish rectal discharge had begun about five months before and had increased in quantity. The stools had become smaller and narrower. He had lost thirty-five pounds in weight.

Proctoscopic examination revealed a carcinoma measuring 8 by 8 centimetres. Exploration was undertaken, May 27, 1926, and two distinct carcinomas, one of the sigmoid and one of the rectum, were found. The sigmoid was brought out by a first and second stage Mikulicz operation and the pathologist reported a carcinoma measuring 3.5 by 2.5 by 0.5 centimetres, with lymphatic involvement, and involvement of 7 centimetres of the sigmoid. June 22, 1926, posterior resection of the rectum was undertaken; an adenocarcinoma graded 3 measuring 6 by 5 by 1 centimetres with extension into perirectal tissue, was reported by the pathologist. Radium was used later.

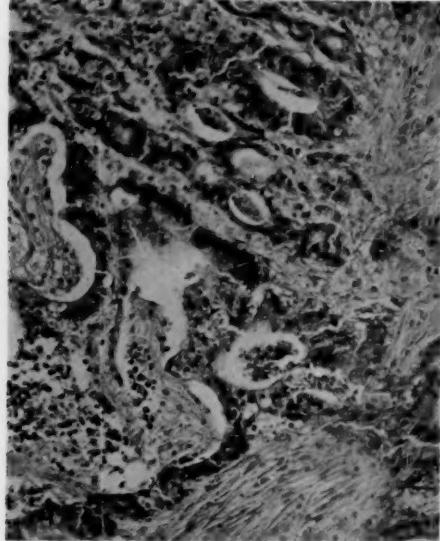


FIG. 8.—Case VI. Microscopic structure of carcinoma resected in 1929.

years, came to the clinic in June, 1928, complaining of rectal soreness, diarrhea of ten months duration, with seven to eleven stools in twenty-four hours, shooting pains, and loss of weight of twelve pounds. Up to a year before, his bowels had been perfectly normal. Specimens of the rectal lesions had been removed elsewhere and a diagnosis of adenocarcinoma had been made.

Proctoscopic examination revealed a polyp on the anterior wall and one on the posterior rectal wall. These were fulgurated.

CASE X.—A woman, aged fifty-four years, came to the clinic January 30, 1928, complaining of rectal trouble which had been present for twelve years, with occasional passage of blood. Six weeks before admission she had had a constant burning pain in the rectum. She had noted loss of weight of ten pounds.

Proctoscopic examination revealed two lesions: one on the anterior anorectal margin, which was an indurated ulcer with a sloughing base, another 3 centimetres above the anus, in the posterior wall, which suggested a sloughing adenoma about 1.5 centimetres in diameter. A specimen removed disclosed an adenocarcinoma graded 3.

Colostomy was performed, February 3. Intra-abdominal metastasis was not found. February 25, posterior resection of the rectum was done, and two adenocarcinomas

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graded 4 were found; one measured 4 by 4 by 2 centimetres, and the other 2 by 1 by 1.5 centimetres. They were 4 centimetres apart and there was lymphatic involvement.

The patient returned, July 25, 1928, with recurrence at the site of resection. Radium was used.

CASE XI.—A woman, aged sixty-five years, came to the clinic in June, 1928. She gave a history of bleeding from the rectum with her bowel movements for three months, with urgency and a frequent desire to have bowel movements. Nevertheless, there had been increasing difficulty in moving the bowels.

General examination revealed nothing of note except a firm, hard, rectal lesion. Proctoscopic examination disclosed two distinct lesions. The smaller one was in the dentate margin, about 5 centimetres in diameter; the larger one was in the left rectal wall, beginning about 8 centimetres above the anus, and was 9 centimetres long by 6 centimetres wide. Exploration, June 8, revealed a carcinoma of the rectum that was inoperable, because of evidence of metastasis to the liver. Colostomy was performed.

CASE XII.—A man, aged forty-five years, came to the clinic in March, 1929, complaining of increased constipation for three years. He had had a bowel movement about once a week during the last year, until, three months before admission, he had begun to have six to eight stools a day with urgency and much mucus, and the stools had been streaked with blood. He had lost fifteen pounds in weight.

Except for the moderately firm growth in the posterior wall of the rectum, nothing of note was discovered in the general examination. Proctoscopic examination revealed a malignant lesion beginning about 4 centimetres above the anus.

Combined abdomino-perineal resection was done, March 26, and a permanent colostomy opening was made because of a carcinoma of the rectum and one of the sigmoid. The pathologist reported three distinct growths, the largest of which measured 10 by 9 by 4 centimetres. Distant from this 5.5 centimetres was another growth 6 centimetres in diameter and 3.5 centimetres from this a third which measured 6 by 5 by 2 centimetres. The condition was one of papillary adenocarcinoma without lymphatic involvement.

CASE XIII.—A man, aged forty-four years, came to the clinic in January, 1929, complaining of having pain in the lower part of the abdomen radiating to the lumbosacral region, and of about five months' duration. Herniotomy had been made elsewhere than at the clinic in October, 1928, without relief. Besides the pain, there had been diarrhoea and bleeding, with movement of the bowels during the five months, and much tenesmus with urgency. He had noted blood in his stools for twenty years and had always had loose stools. He had lost twenty pounds in weight in five months.

Except for a mass in the rectum and the scar of recent herniotomy, there was nothing noteworthy found on general examination. On the posterior rectal wall could be felt a pedunculated mass, and high on the anterior rectal wall a fixed mass. A röntgenogram of the colon disclosed a filling defect of the sigmoid. Exploration revealed multiple malignant polyps of the rectum and sigmoid; the largest one was obstructive, and for this a Mikulicz colostomy was done. The pathologist reported an adenocarcinoma measuring 5 by 4 by 2.5 centimetres.

CASE XIV.—A man, aged sixty-eight years, came to the clinic because of rectal trouble of a year's duration. There had been bleeding, with hard stools. Hæmorrhoidectomy had been done about ten months before admission. Following this there had been a more or less constant desire to go to stool, with urgency, but often only gas, mucopurulent material, and blood had been passed. He also had mild diabetes. He had lost fourteen pounds in weight.

Moderate arteriosclerosis was found to exist. Otherwise, general examination revealed nothing of note except two immovable masses. One mass was on the anterior wall, just above the anus, and the other at the juncture of the rectum and sigmoid, and was much larger.

Exploration, January 18, revealed a malignant condition of the rectosigmoid, that

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was inoperable because of metastasis to the liver. Biopsy disclosed adenocarcinoma graded 2.

CASE XV.—A woman, aged forty-six years, came to the clinic in June, 1929, because of rather constant pain in the left lower part of the abdomen. The pain was increased by eating and drinking, was accompanied by much bloating, and it radiated to the left hip and the vagina. It was of many years' duration. Occasionally for many years mucus and blood had been noted in the stools.

Proctoscopic examination revealed a malignant lesion high in the sigmoid. Resection for obstructing carcinoma of the sigmoid was done, June 24, 1929. The pathologist reported adenocarcinoma graded 2, 3 by 3 by 1 centimetres, with lymphatic involvement. Distant from this 4 centimetres was a carcinomatous polyp, 1 centimetre in diameter. The latter was an adenocarcinoma graded 1.

CASE XVI.—A man, aged fifty-six years, came to the clinic in July, 1929, stating that he had a growth in the rectum. For a year he had noticed in the stools mucus and pus which had been said to be due to "colitis," and he had been having about three bowel movements a day. Three months before admission he had seen the first blood in his stools and this had continued off and on, and until his admission. A month before admission he had been examined elsewhere and a diagnosis of adenocarcinoma had been made.

On admission, except for the fact that his weight was eleven pounds less than what he claimed to be normal for him and except for a benign type of hypertension, general examination gave essentially negative results. However, proctoscopic examination revealed a malignant lesion involving the right half of the rectosigmoid. Below this there were two large polyps, one about 6 centimetres above the dentate margin and the other 30 centimetres above the anus.

July 15, permanent colostomy was performed, and on August 3, posterior resection of the rectum for carcinoma. The pathologist reported adenocarcinoma graded 2, measuring 4 centimetres, 4 by 4 by 1.5 centimetres, and two carcinomatous polyps.

COMMENT

Multiple primary malignant lesions in various tissues of one person, and occurring at the same or widely separated intervals of time, have been frequently recorded. Similar malignant tumors, occurring in the same organ at the same or different times, have rarely been described. Carcinomas of a hollow viscus that are essentially alike or closely related and that are distinctly separate primary malignant lesions are rare, but probably they are not as infrequent as formerly has been supposed. We feel that in each of these cases we were dealing with two or more distinct, primary, malignant lesions. That this fact has a distinct bearing on treatment and prognosis needs no further emphasis.

The question of the origin of these tumors and the probable reasons for their occurrence offers much food for speculation. The frequent occurrence of single adenomatous polyps throughout widely disseminated portions of the colon has been discovered at necropsy, has been revealed by röntgenograms after barium enemas, has been disclosed by proctoscopic search for disease, or has been suspected because of unexplained rectal bleeding. Polyps should be considered omens of possible future malignant disease of the large intestine.

It is not known, nor is it fair to predict, whether or not a given polyp will become malignant. However, careful investigation of every case of

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rectal bleeding, and removal of the cause of such bleeding, offers much hope for early recognition of malignant disease of the colon and its subsequent eradication. Multiplicity of such lesions is probably much more common than is now suspected.

BIBLIOGRAPHY

- ¹Cabot, R. C.: Cabot's case No. 12442. A case of cancer of the colon with cancer of the colon again after ten years. *Boston Med. and Surg. Jour.*, vol. cxcv, pp. 906-911, November, 1926.
- ²Dowden, J. W.: Carcinoma of pelvic colon: resection three years later, recurrence in rectum: colostomy one year later, carcinomatous stricture, small intestine: resection, carcinoma at colostomy opening: death six years after first operation. *Edinburgh Med. Jour.*, vol. xix, pp. 181-183, September, 1917.
- ³Elliott, Ellsworth, Jr.: Recurrence versus metastasis in carcinoma. *Tr. Am. Surg. Assn.*, vol. xl, pp. 115-120, September, 1922.
- ⁴Ewing, James: *Neoplastic disease*. Ed. 3, Philadelphia, W. B. Saunders Co., p. 89, 1928.
- ⁵Fenger, Christian: Double carcinoma of the colon. *Jour. Am. Med. Assn.*, vol. xi, pp. 606-607, October, 1888.
- ⁶Major, R. H.: Multiple primary malignant tumors. *Johns Hopkins Hosp. Bull.*, vol. xxix, pp. 223-231, October, 1918.
- ⁷Miller, R. I., Jr.: Multiple primary malignant foci in cancer of the colon. *ANNALS OF SURGERY*, vol. lxxx, pp. 456-472, September, 1924.
- ⁸Phillips, E. V., and Macbeth, J. S.: Diffuse adenocarcinoma of the colon. *Brit. Med. Jour.*, vol. ii, p. 524, September, 1926.
- ⁹Rankin, F. W.: *Surgery of the colon*. London, D. Appleton and Co., p. 255, 1926.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

STATED MEETING HELD JANUARY 22, 1930

The President, DR. EDWIN BEER, in the Chair

OSTEOMYELITIS OF SPINE

DR. WILLIAM B. PARSONS, JR., presented a man who was forty years old in December, 1927, when he came to the Presbyterian Hospital complaining of soreness in his pelvic bones which had been felt for one week. His family history was apparently unimportant, and his previous history was singularly free from acute and chronic diseases. Several years ago he weighed 180 pounds, but on admission and since, in the follow-up clinic, his weight has been in the neighborhood of 165 pounds.

About five months before admission, he went to bed feeling well, but woke up with severe pain in the perineum. The following day both testes were swollen, but following rest and the application of an ice-bag they returned to normal size in two days, and the pain had disappeared from the perineum. Pain, however, appeared in the kidney region and again lasted a few days, to disappear and move up to the thoracic region of the back. Although his temperature was never above 100° and he had no cough, no sputum and no painful respiration, a diagnosis of "pleurisy" and "pneumonia" was made. He was kept in bed for four weeks and improved considerably. He was then sitting around in the house, convalescing, for about two weeks, when there suddenly developed terrific pain in the left side, principally in the region of the hip. He was told that this was "neuritis." This pain recurred from time to time until admission to the hospital. Three months before admission, a painful swelling appeared in the region of the anterior superior spine. Soon afterwards the "neuritis" pains became very severe, and ran through the pelvis from side to side.

He went to a hospital in New Jersey where he was two weeks under observation. X-rays from head to foot were reported negative, as were blood counts, urine analysis and cystoscopy. He was then operated on for pus in the left iliac crest. The bone was scraped and the wound was packed. This was eight weeks before admission, and the wound was still granulating. He was in bed five weeks after the operation, and apparently had another attack of pneumonia. He was at home for two weeks and was fairly well, except for pain in the lower part of the spine. The week before admission, pain and soreness began in the pubis and in the ischial tuberosities, particularly on the left side, so that walking, sitting and standing were extremely difficult, and he was not very comfortable lying in bed. An occasional evening rise in temperature had been noticed, but no difficulty was experienced in defecation or urination.

On physical examination the significant findings were a markedly enlarged liver, a palpable spleen, a rigid but, interestingly enough, non-tender spine. There was, however, marked resistance to forcible extension of the left thigh. There was tenderness over the left ischial tuberosity which was quite definite. The symphysis pubis was moderately tender. Over the left iliac crest there was a nearly healed operative scar. Urine was clear; blood-pressure was normal; Wassermann was negative; liver function test was normal; there was slight concentration of the blood, with 6,000,000 red cells having a haemoglobin of 95 per cent. and 11,800 white cells with 76 per cent. polymorphonuclear leucocytes; the rectal examination was negative.

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X-ray examination on admission showed slight thickening of the apical pleura and slight exaggeration of the bronchial shadows in the right lower lobe. No shadows representing tuberculous infiltration were seen. A small linear shadow was seen lateral to the anterior part of the crest of the left ilium. A destructive process was noted in the left ischial tuberosity. Stereos of the lower lumbar vertebrae and a flat lateral view showed evidence of a pathological process involving the adjacent margins of the fourth and fifth lumbars and the intervertebral disc. The latter was definitely narrowed but not obliterated. The adjacent margins of the vertebrae appeared to be fairly sharply defined and straight, and possibly slightly increased in density as compared with the upper margin of the fourth lumbar for example. The left side of the upper margin of the fifth was beveled off, as was, to a less extent, the adjacent margin of the fourth. The right side of the lower margin of the fourth showed this sharply defined bevel more distinctly. There was nothing to suggest a pari-vertebral abscess. In the lateral position there seemed to be a slight but definite increase in density on either side of the narrowed intervertebral disc. Dr. Ross Golden felt that this was against tuberculosis, but there was no evidence of new bone formation which ought to be present to justify completely the interpretation of this as being due to a non-tuberculous lesion. He was seen by several orthopaedic consultants who agreed that it was probably tuberculosis, but they differed as to the advisability of doing a fusion operation on the spine.

Tenderness over the left tuberosity of the ischium increased, and the patient's temperature, which had been from 99° to 100° during the first week in the hospital, went up in the next week to range around 101° to 102°, so the left tuberosity was explored. A zone of oedema over the bone was found, but no pus was encountered. The tuberosity of the ischium was softened and definitely crumbly. The bone was curetted and packed with iodoform gauze. Cultures from the oedema fluid and the edematous tissue and the bone all grew out *B. acidi laeti*. Microscopical examination of the bone and soft tissue was reported as follows:

"The specimen said to be curettings from the ischium shows on section numerous bony trabeculae which appear to be proliferating, for along their margins are seen numerous osteoblasts. Between the trabeculae is a marked infiltration with round cells, plasma cells and large phagocytic mononuclear cells, the latter contain much brownish pigment. A very few polymorphonuclears are also found here. Occasional haemorrhagic areas are seen. A portion of soft tissue removed with the curettings shows on section a mass of slightly oedematous connective tissue in which there is a large infiltration with round plasma, large mononuclears and also numerous polymorphonuclears. In one area the tissue is undergoing necrosis. Diagnosis—*Chronic suppurative osteomyelitis of ischium.*" Doctor Stout made a footnote to the effect that—"It is evident that this is an infection with an unusual organism as the reaction to it is unusual."

X-rays taken one and two months after operation seemed to show a little more destruction of the fourth lumbar with a slight broadening of the bevel and further narrowing of the intervertebral disc. Films of the pelvis showed an extension in the process in the ischium along the surface of the bone from the acetabulum nearly to the pubic symphysis.

The operative wound was healed in thirty-six days. He was given ultraviolet light, was allowed up on the forty-third day, and went home on the seventy-fifth day after operation, having been walking for about two weeks.

He improved gradually but steadily at home. By six months, he could do about half hour's work. The lower spine was stiff but straight, and was not tender. The liver was still three fingers below the costal margin. By nine months, after a strenuous summer vacation, he was in excellent condition and was doing his full work. At fifteen months, after landing hard on both heels, a swelling appeared over the left ischial tuberosity, and the old wound discharged slightly for a while. Last December, twenty-four months after operation, he was in excellent health. The nature of his work requires a sixteen-hour day once in two weeks, and then he has a tired feeling in his back, associated

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with general fatigue. The lumbar spine was nearly rigid but not tender. The liver was still palpable. X-rays taken during the follow-up showed a gradual narrowing of the intervertebral disc and change in the architecture of the bone, indicating subsidence of the process but with increase in the beveling, and at two years almost complete loss of the intervertebral disc and definite evidence of ankylosis.

This case is presented as a somewhat unusual example of a comparatively infrequent condition. Wilensky, in the *ANNALS OF SURGERY* for April and May, 1929, reviewed the subject of osteomyelitis of the spine. In the vast majority of the cases, acute osteomyelitis is a disease of adolescence, usually being confined to the dorsal or lumbar spine. Most of the cases associated with the usual pyogenic organisms were followed by abscess formation, and in his article Wilensky discusses the symptomatology and course and finally the formation of abscesses. Since 1905, the mortality from the pyogenic type has ranged from 35 per cent. to 45 per cent., with an interesting difference in the cases quoted by Donati, who found lesions of the arch with a mortality of 33 per cent., but a 78 per cent. mortality for lesions of the body.

The bacteriology of the spinal disease in this case was not subject to proof, and the organism causing the iliac crest infection is not known. The organism involved in the ischial tuberosity disease was of low virulence and associated with a corresponding cellular reaction and no pus formation. One has a right to assume that the other bone lesions were similar in nature, and that probably the lesion in the ischial tuberosity would have subsided without incision and drainage.

SUBUNGUAL MELANO-CARCINOMA OF THUMB

DR. WILLIAM B. PARSONS, JR., said that in the November, 1927, *Archives of Surgery*, N. A. Womack, of St. Louis, reported on four cases of subungual melanoma or Hutchinson's melanotic whitlow, bringing the total of reported cases up to twenty-five. Since then, no cases have been reported.

The origin of these neoplasms has been variously ascribed to epithelial, mesothelial and endothelial cell origin, but in as much as melanin seems to be only of epithelial origin, the weight of evidence, as stated by Bruno Bloch, would favor their origin as epithelial.

In the reported cases, trauma was particularly frequent in the lesions in which pigmentation was not an early feature. In the cases without trauma, a discoloration in the nail-bed was usually the first thing noted, followed by ulceration and usually a secondary infection. Metastases are usually found in the anticubital and axillary spaces, although in Boyer's case the initial lesion existed as a pigmented area for thirty years.

Of the 25 cases reported by Womack, 9 were not followed; 3 were dead at unknown intervals; 7 had recurrence in from two to eight years—of these, 4 were dead; the remaining 6 had no recurrence (one at two months, one at six months, one at one year, two at two years, one at four years).

He now presented as an example of the condition in question a woman, forty-seven years of age, who had presented herself at the hospital in December, 1925, at the age of forty-three. Ten years before, she had pleurisy with haemoptysis, and was sent to Otisville for three months, but was not put to bed, and her cough had ceased before her return to New York. Health otherwise had been excellent. Approximately eight years before, she noticed black stripes on or under the nail of the left thumb. Gradually pieces of the nail broke off, and for the last two years there had been no thumb nail present. The nail-bed bled very easily on the slightest trauma. There had been a gradual enlargement of the end of the thumb for the twelve months before admission.

SUBUNGUAL MELANO-CARCINOMA OF THUMB

On admission, the positive findings were a blood-pressure of 155/110; a few crackles at the right apex, but a negative X-ray of the lung field. Locally, the distal portion of the left thumb was moderately swollen; the nail was absent, and the nail-bed was represented by a mass of exuberant granulation tissue. X-ray examination of the thumb showed no evidence of bone sarcoma or osteomyelitis. No enlargement of the lymph glands could be made out.

A biopsy was done, a procedure of distinctly doubtful advisability. This showed a mass of connective tissue infiltrated with lymphocytes and polymorphonuclear leucocytes, with numerous strands or groups of large cells with hyperchromatic nuclei, many of which contained brown granular pigment, negative for iron.

On Doctor Stout's suggestion, the thumb was amputated, and the axillary lymph glands were removed. The microscopical examination was reported as follows:

"Section consists of a mass of tumor cells with connective tissue stroma and bordered by a bit of skin. The tumor cells are in cord-like arrangement penetrating all parts of the section in no definite manner. The nuclei are rather long hyperchromatic and of various sizes and shapes. There are a few mitoses. Collections of round cells are present in the stroma with occasional polymorphonuclear leucocyte and plasma cells. The axillary lymph glands, 10 in all, are free from metastases. The germinal centers and reticulo endothelial system in general are very prominent. *Diagnosis—Melano-carcinoma of thumb.*"

Five days after operation a moderately severe haemolytic staphylococcus aureus infection occurred. This, however, progressed satisfactorily, and was at all times localized to the amputation stump.

The follow-up findings have been of considerable interest. The patient was most faithful, and returned many times to the follow-up clinic and at frequent intervals from March, 1926, until December, 1928, for radiotherapy, which was given to the left upper chest, sternal region, left antecubital fossa and both hands. The amputation stump was very slow in healing, but eventually repair was completed.

At fourteen months after operation, she complained of a painful stump, and on the thumb, index and middle fingers of the right hand dark streaks were noted, which she stated were similar to the area on the left thumb prior to the appearance of the tumor. Following radiotherapy there seemed to be some improvement. At eighteen months everything was satisfactory. Similar findings at twenty-four months; but at thirty-one months a small dark spot 3 millimetres in diameter was noted between the knuckles of the index and middle fingers of the left hand. Examination of this showed spindle-shaped cells growing irregularly between connective tissue bundles, with both intra- and extra-cellular pigment in the new growth. This pigment again did not show the reaction for iron. Three months later another small bluish spot was noted in this region, and on the right hand nearly all of the middle finger nail presented bluish streaks. Radiotherapy was continued, and in two months streaks were visible on the other nails of the left hand. By thirty-eight months the right index finger was better, the right middle finger was worse. The left index showed more pigmentation and the left middle finger less, a transverse line across this nail having completely disappeared. At this time she was also complaining of puffiness of the hands and some pain in all the joints. An X-ray at this time showed slight hypertrophic changes about the margins of all of the phalanges of both hands and of the carpus of the left. At forty-one and forty-six months, after operation, no new evidence of recurrence was noted, the finger nail streaks were in general better, and the second blue spot had disappeared.

This patient is now four years and one month after the operation. Minor recurrence was proved in the skin, and a similar condition was suspected in all the subungual spaces. Frequent radiotherapy had apparently been of great importance in controlling the condition.

The reporter inquired if any member of the Society had had any experience in

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grafting bone into a thumb amputation stump. If this patient had even two centimetres of greater bone length, she would have a longer stump that would help greatly in the grasp of this hand.

This patient was shown as an example of a rare condition with a longer follow-up than most of the recorded cases. If a biopsy is to be done in this type of case, it should certainly be done as a frozen section. Amputation and dissection of the axillary lymph glands, followed by intensive X-ray treatment, would seem to be the best method of procedure.

INTRATHORACIC GOITRE IN AN ELDERLY PATIENT

DR. WILLIAM B. PARSONS, JR., presented a man who was seventy-nine years of age when he came to the Presbyterian Hospital in the latter part of December, 1927, complaining of marked dyspnoea. The complaint had been in existence for two years, having started as the sequel to a severe coughing spell, after which he suddenly noticed a lump in the left side of his neck. Before that time breathing had been unobstructed, but following the partial dislocation of the left lobe of the thyroid, there had been gradually increasing dyspnoea, presumably caused by an angulation of the trachea at the superior thoracic aperture, not having been present when the thyroid was completely intrathoracic. When he presented himself, he had a mild upper-respiratory infection which had resulted in marked hoarseness and a great increase in dyspnoea.

Except for a prostatectomy in 1914, and some exploratory operation on the kidney in 1915, his general health had been excellent throughout his long life. As far as he knows, he was the only member of his family to have a goitre. There was certainly none present in his four sisters and six brothers, and none in his antecedents as far as he knows. With the exception of a large nodular goitre with marked tracheal displacement to the right, his general physical examination revealed an unusually active and well-preserved man of seventy-nine years.

Operation, under local anaesthesia, revealed a marked enlargement of the left lobe of the thyroid due to the presence of many adenomata with some large and small cysts. In one section, microscopically, there was a surprising preponderance of lymphoid tissue. The other lobe contained a few small, firm nodules, and was not disturbed. Ordinarily, of course, a bilateral procedure would have been followed, but because of his age, and the fact that he was somewhat tired after the left side had been attended to, the operation was limited to removal of the intrathoracic adenomata. The procedure followed was similar to that well described by Pemberton in the 1921 *Archives of Surgery*, namely, the control of the superior vessels, the division of the isthmus and the avoidance of dislocation of the intrathoracic portion until the inferior thyroid vessels had been controlled. Since operation, this patient has followed his occupation of upholsterer with marked improvement in his comfort.

ILEOSTOMY IN EXTREME CASES OF TOXIC ILEUS

DR. WALTER A. SHERWOOD presented three cases.

CASE I.—A boy, eleven years of age, was admitted to the Brooklyn Hospital September 19, 1929, with the typical story of acute appendicitis and spreading peritonitis. He had been ill for three days with severe abdominal pain and repeated attacks of vomiting. When first seen he was extremely ill and showed every evidence of a well-advanced general peritonitis. The temperature was 102° F., pulse rate 120. The white blood cell count was 12,000 with 94 per cent. polymorphonuclears. The urine showed 2 plus acetone. The abdomen was markedly distended, there was board-like rigidity of all abdominal muscles and although tenderness was generalized it was most marked in the right iliac fossa. An immediate drainage operation seemed indicated and the abdomen was opened through a right rectus incision. Free purulent fluid escaped in large quantity. The extremely poor condition of the patient did not warrant a further search for and removal of the ruptured appendix. A rubber drainage tube was intro-

ILEOSTOMY IN EXTREME CASES OF TOXIC ILEUS

duced into the pelvis and a second one was placed in the lateral gutter between the caecum and abdominal wall. The peritoneum was closed in the usual manner; the muscles and fascia were only partially sutured and the superficial structures protected with side bolsters of rubber tubing. The post-operative course of the patient was a very stormy one. Distention was extreme, particularly of the upper abdomen; the patient vomited repeatedly and presented the typical appearance of one gravely ill with a peritonitic toxæmia. Lavage, intravenous glucose and hypodermoclyses were employed at regular intervals but with only temporary relief of symptoms. Seven days after operation the wound became disrupted and a loop of small intestine protruded through the lower angle. This was freed, dropped back in the abdominal cavity, and held in place by a layer of rubber-dam ten inches square. The wound was re-sutured and the structures approximated with through and through mass sutures of blue tension silk. The gastro-intestinal paresis continued and was partially kept in check by repeated stomach washings and enemata.

The patient lost flesh rapidly and became dehydrated. Two blood transfusions of 300 cubic centimetres each were given as supporting measures and seemed to be helpful. Three weeks after operation the distention was more difficult to control. Enemata were given without result and the patient exhibited the signs of a definite mechanical obstruction. Visible peristalsis was present in the upper abdomen and large quantities of dark-greenish material were being regurgitated. He was again taken to the operating room and through a left rectus incision slightly above the level of the umbilicus, the first presenting loop of distended small intestine was brought out, a trochar and cannula were introduced, allowing the escape of large quantities of fluid intestinal content and gas. A rubber catheter was introduced into the bowel through the trochar puncture wound and held in place after the method of Witzel. The intestine was dropped back and the wound partially closed. On the day following this simple procedure the entire clinical picture had changed. Vomiting ceased. Distention completely disappeared and the abdomen became soft and scaphoid. Normal bowel action was established on the second day, and from this time on improvement was continuous and rapid. The discharge from the opening in the small intestine was profuse for a week, at the end of which time the catheter was removed and the opening plugged with gauze. In another week the fistula ceased to discharge and the wound healed rapidly. The patient left the hospital early in November and has remained well. He presents a rather badly scarred abdominal wall with some weakness of the muscular structure which may require subsequent repair.

CASE II.—A boy, ten years of age, was admitted to the hospital November 11, 1920, with a three-day history of abdominal pain and vomiting. Examination revealed moderate distention, generalized tenderness and rigidity, most marked in the right lower quadrant. Temperature 101.2° F. Pulse rate 125. Respiration 30 and of the costal type. White blood cell count 19,000 polymorphonuclears 87 per cent.

An immediate operation was done, the abdomen being opened through a three-inch right rectus incision. There was free pus in the pelvis, and the appendix was buried in an omental mass at the pelvic brim. The tip of the organ was gangrenous and perforated. It was removed in the usual manner, the stump was buried and a rubber tube drain was introduced into the pelvis.

Following operation this patient was very ill with the characteristic signs of gastro-intestinal paresis of toxic origin. Vomiting and distention were only temporarily relieved by lavage and enemata. On the eighth post-operative day abdominal cramps, distention and repeated vomiting suggested the probability of mechanical obstruction. He was again taken to the operating room and through a two-inch left rectus incision an enormously distended small intestine was seen. Several organized omental bands were freed, and a small quantity of creamy pus escaped. A puncture wound was made in the distended bowel which was thought to be the midportion of the ileum and after large quantities of gas and intestinal content had been evacuated, a rubber catheter was intro-

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duced through the puncture wound and held in situ by the Witzel method. The intestine was dropped back and the wound left open except for a light gauze packing around the tube.

From this time on there was no further vomiting; distention disappeared rapidly and normal bowel action was established on the second post-operative day. The tube accidentally slipped out on the third day following which there was a temporary cessation of discharge and increased distention. This was later followed by a profuse discharge with rapid and complete recovery. Within ten days there was no further leakage of intestinal contents; the wound healed promptly and the patient left the hospital and has remained well.

A third case of an exactly similar nature was to have been presented this evening. She was a young girl, six years of age, with even a more severe grade of peritoneal toxæmia than those presented. The same procedure was carried out with recovery of the patient, but a complicating mastoiditis made it unwise to transport her from the hospital. In this instance the intestinal fistula is not yet healed.

COMMENT

These three cases occurred within a few weeks of each other and although, in the past, while he had been rather indifferent in his advocacy of secondary ileostomy for the relief of toxic ileus, he was nevertheless firmly convinced that in each of these cases this simple procedure proved to be a life-saving measure in patients who would otherwise have succumbed to the profound toxæmia of general peritonitis. He was recently asked to see a patient at another hospital in consultation, who was also suffering from an extreme grade of toxic ileus associated with peritonitis following an hysterectomy. She was extremely ill, enormously distended, vomiting persistently and not relieved by any of the generally used measures. An ileostomy was advised, performed by the surgeon in charge of the patient and he has been informed that she is making a satisfactory recovery. This simple measure should be more generally utilized in similar conditions.

DR. SEWARD ERDMAN recalled that he had reported on similar cases from the New York Hospital which he had reported to this Society a few years ago. In the discussion Doctor Mathews expressed the opinion that many unnecessary operations were done; a statement to which probably all will agree. The reason Doctor Erdman referred to this now was because of the title, toxic ileus, given the two first cases. He was sorry the third case had not been presented more in detail as there were indications that this was a toxic case, but he did not consider that the two cases presented had toxic or paralytic ileus. Undoubtedly both originally had spreading peritonitis, but when the indications for enterostomy are not clear before the twenty-first day after the primary operation, as in the first case, and the eighth day in the second case, the speaker believed those cases came under the heading of mechanical ileus. Experience shows that the mortality and prognosis of enterostomy is different in the two types of cases; if enterostomy were done within three days after operation for peritonitis one might feel one was dealing with the ileus of peritonitis or toxic, paralytic ileus. But when one is able to wait for a week or ten days the patient is overcoming the toxic

SPLENECTOMY FOR CHRONIC PURPURA HÆMORRHAGICA

phenomenon and one is dealing rather, with mechanical ileus in which enterostomy sometimes works like magic and has saved lives.

DR. FRANK S. MATHEWS considered the first case reported by Doctor Sherwood as being a particularly appropriate one for ileostomy. The peritoneal sepsis had apparently been overcome and was followed by obstructive symptoms, probably due to loose recent adhesions. In such a case the patient's condition would not warrant an exploration to discover the point of obstruction and possibly this point would be hard to locate. The ileostomy was life-saving at the moment, and later the obstruction presumably relieved itself by the stretching out and disappearance of the adhesions, which in such cases probably is dependent upon peristalsis of the intestines.

DOCTOR SHERWOOD, in closing the discussion, said that he regarded Doctor Erdman's criticism as a fair one. He expressed his regret at not being able to present the third case which was more representative of true toxic ileus. In this case ileostomy had to be done at the end of the sixth day following the original operation. Although it may be assumed that mechanical obstruction had supervened in each of these patients, the underlying cause of the trouble was a paralytic ileus, as the result of which the small bowel became overdistended with fluid, dropped into the pelvis of its own weight and became obstructed as the result of torsion or angulation.

CYSTIC TUMOR OF THE SCAPULA

DR. WALTER A. SHERWOOD presented a girl, eight years of age, who was admitted to the Brooklyn Hospital in August, 1929. Three weeks previously her mother had noticed a mass protruding from the region of the right shoulder blade. Her only complaint was slight pain on motion of the arm. Over the right scapula and apparently connected with the body of the bone was a firm hard mass about the size of an orange. There were no inflammatory signs and the overlying skin was freely movable. The range of motion in the shoulder joint was but slightly impaired.

Stereoscopic X-ray study revealed a bony tumor involving most of the body of the scapula and having the general appearance of an osteogenetic sarcoma.

August 16 the scapula was resected through a transverse incision. The tumor involved the entire body of the bone. Grossly the mass appeared to be a degenerating sarcoma. The neck was divided with chisel and bone-cutting forceps and the body, including tumor, muscles and scapular spine were removed. The subscapularis muscle was left intact. The muscle stumps and skin flaps were sutured and a cigarette drain was introduced. The wound healing was prompt and satisfactory.

Pathology—Microscopic examination showed a benign cystic bone tumor of the giant-cell type. It is now five months since this tumor was removed. Recent X-ray studies failed to reveal any evidence of intrathoracic or other remote metastases. The local condition is excellent. It would seem that the pathologist's report that this is a benign giant-celled tumor is in all probability correct. The case is presented because of the comparative rarity of such growths in other than the long bones and because of the excellent functional result obtained coincident with the extensive sacrifice of large and important structures on the dorsal surface of the scapula, principally the supra- and infra-spinatus muscles and the major portion of the scapula itself.

SPLENECTOMY FOR CHRONIC PURPURA HÆMORRHAGICA

DR. WALTER A. SHERWOOD presented a woman, thirty-nine years of age, who was first admitted to the medical service of the Brooklyn Hospital September 15, 1928,

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because of persistent bleeding from the nose and bowel. She had purpuric spots on various parts of her body which she had first noticed on the day before admission. She stated that she had been in good health except for a skin lesion (*lupus erythematosus*) for which she had been under treatment with hypodermic injections of a colloidal gold preparation and to this treatment she attributed her bleeding. She had never noticed any tendency to excessive bleeding nor was there any suggestive family history of a similar condition. She was a well-nourished, drowsy, anaemic woman, who seemed acutely ill. The skin over the entire body was studded with subcutaneous haemorrhages, ranging from large ecchymotic areas to small petechiae. These were noted on the conjunctivæ on the roof of the mouth, over the flanks, trunk and extremities. The positive findings at this time were mostly limited to the skin and mucous membranes. Heart and lungs negative. There was no lymphadenopathy, the liver and spleen were not palpable and no masses were felt in the abdomen. On admission the body temperature was 99.4° F. Pulse rate 86, quality weak. Blood examination revealed: Haemoglobin, 35 per cent.; red blood cells, 2,000,000; color index, 0.9; white blood cells, 8,800; polys, 78 per cent.; lymphocytes, 22 per cent.; platelet count, 128,000; coagulation time, 5 minutes; bleeding time, prolonged; blood Wassermann, negative.

On the second day following admission the patient became markedly worse. She vomited blood repeatedly and passed large amounts of fluid blood and clots from the bowel and vagina. The urine was also found to contain gross blood. During the first week of her stay in the hospital she was given four blood transfusions. After the last transfusion she began to improve and the amount of bleeding decreased. Moderate oozing continued for three days and a fifth transfusion was given. The haemoglobin then increased to 60 per cent. and the skin ecchymoses gradually disappeared. The patient felt much better and was discharged greatly improved on October 16, 1928, to return to the out-patient department for continued observation. Three weeks previous to her second admission to the hospital on January 7, 1929, she noticed that the purpuric spots were reappearing and became so numerous that she became alarmed. On admission there was the same distribution of petechiae as before although as yet no gross bleeding. The haemoglobin at this time was 78 per cent., erythrocytes 4,000,000 and the platelet count was 112,000.

On the fifth day after entering the hospital vaginal bleeding again started and continued up to the time of operation. Repeated examination of the blood showed a rapidly advancing anaemia and she was given three supporting blood transfusions. A clot retraction test revealed that there was no retraction at the end of forty-eight hours. She also had a positive tourniquet test. The platelet count was now 44,000.

The patient steadily became weaker and on February 18, the advisability of splenectomy was considered. At this time the relationship of the gold injections to the present condition was discussed and the relationship considered only coincidental.

February 21, after a preliminary blood transfusion, a rapid splenectomy was done through a left rectus incision. There was moderate perisplenitis as evidenced by numerous adhesions. No particular difficulty was experienced, and a spleen which appeared normal in size, consistence and color was readily removed. At operation there was a moderate amount of general oozing, but this was readily controlled with hot pressure pads and the usual measures. The wound was closed without drainage.

The recovery from operation was uneventful except for an elevation of temperature which continued for twelve days and could not be accounted for. The pathological report stated that the spleen was of normal weight and appearance and the microscopical findings were those of a normal spleen. Three days after operation the platelet count had risen to 190,000. On the ninth day the haemoglobin was 80 per cent. and the red cell count 4,480,000. From this time on recovery was rapid and there were no further evidences of bleeding. The patient left the hospital in excellent condition and has remained well. The case is reported for the purpose of recording an additional one of persistent and uncontrollable purpura haemorrhagica in which removal of the spleen

SPLENECTOMY FOR BANTI'S SYNDROME

seemed to have an immediate and decidedly beneficial effect in altering both the blood picture and its coagulability. The rapid increase in the platelet count following operation was of especial interest.

DR. EDWIN BEER suggested that the post-operative rise in temperature, which continued for twelve days in this case, which always occasions some perplexity, was due to injury to the tail of the pancreas. He had seen such febrile movements repeatedly in undrained splenectomies and had been in doubt usually as to the cause.

DR. JOHN F. CONNORS stated that he had frequently noted this rise in temperature in the cases of splenectomy which he had done for trauma. In these cases, which were done hurriedly, it was thought that it was due to injury done to the tail of the pancreas by catching it in the ligature of the splenic vessels. Subsequently, in some, although not all of these, there was a breaking down of the abdominal wall which led to this conclusion.

SPLENECTOMY FOR BANTI'S SYNDROME

DR. WALTER A. SHERWOOD presented a young man, seventeen years of age, who entered the hospital October 18, 1929. His chief complaints were pain in the upper right side of the abdomen and vomiting of blood. Six months previously, while at work, he suddenly vomited a large quantity of blood. This was followed by tarry stools; subsequent to this he was weak and anaemic and remained in bed for seven weeks. He apparently recovered from this attack, although his pallor continued.

Ten days previous to admission, he again had a feeling of faintness, went to bed, and on the following morning vomited over a quart of bloody material, with many clots. The stools were very dark and continued to be so up to the time of entering the hospital. On the day following admission he again vomited blood, complained of air hunger, and was very restless.

Family and past personal history was negative. Examination revealed a very anaemic, weak patient, with marked greenish yellow pallor of the skin. He had a systolic heart murmur at the apex. The spleen was palpably enlarged, tender, and firm. There was tenderness in the right iliac fossa, with the suggestion of a mass in this location. Admission temperature was 103.6° F. Pulse rate 110. Blood-pressure 130/50.

Blood examination: Haemoglobin, 22 per cent.; red blood cells, 2,560,000; blood platelets, 32,000; white blood cells, 8,000; polymorphonuclears, 85 per cent. Blood culture, smears and Widal negative. Coagulation and bleeding time each three minutes. Clot retraction time normal.

The urine was negative except for the presence of few red and white blood cells.

Stools positive for blood. Icterus index 3.9. Vandenberg test showed no reaction. Fragility of cells normal. Smears for malarial parasites negative.

A provisional diagnosis of bleeding gastric ulcer was made, but could not be substantiated by subsequent study. Treatment consisted of an appropriate diet and blood transfusions. He did well for a time. The haemoglobin increased to 45 per cent., after which he had another severe gastric haemorrhage, and the haemoglobin again fell to 28 per cent. Following repeated transfusions the blood picture improved, and a probable diagnosis of Banti's disease was made on the basis of splenomegaly, the presence of a small amount of free ascetic fluid in the abdomen, and the repeated gastric haemorrhages. Splenectomy was advised and performed on December 9, 1929.

There was marked perisplenitis, and considerable difficulty was experienced from massive haemorrhage following the manual release of adhesions. The bleeding was controlled with a gauze tampon and pressure, after which the enlarged spleen was

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easily delivered and removed. There was a moderate amount of clear free fluid present, and the liver, though small, did not show any of the characteristic cirrhotic changes. Exploration of the stomach and duodenum failed to reveal any evidence of an ulcer or other lesion which might have been responsible for the previous haemorrhage. A post-operative blood transfusion was given, with much benefit. The patient has made a satisfactory recovery, with steady improvement in his general condition and appearance. In the past two weeks he has gained ten pounds.

The most recent blood examination is as follows: Haemoglobin, 53 per cent.; red blood cells, 3,200,000; platelets, 125,000.

Pathology.—The spleen is 20 centimetres in length, 10 centimetres wide, and 8 centimetres thick. Weight 550 grams. The capsule is thickened, purplish gray, with numerous white thick patches. The vessels on the hylic side are enlarged and prominent. On section the follicles are readily visible, and the connective tissue framework is increased in amount. *Histological.*—There is a definite increase in fibrous tissue, markedly augmenting the total bulk of the organ. The pulp is decreased and the venous spaces are enlarged and have thickened walls. *Diagnosis.*—Interstitial fibrosis of the spleen. The findings are consonant with the clinical entity known as Banti's disease.

Comment.—Because of the difficulty experienced in controlling dangerous haemorrhage in this case, the suggestion is ventured that no operation on the spleen should be attempted without a preliminary transverse incision in addition to the vertical one. The failure to utilize this additional exposure on the patient, except as an afterthought, greatly increased the technical difficulties of the operation and added to its risk.

DR. RICHARD LEWISOHN, speaking of the incision for splenectomy, stated that he always made an incision along the left costal arch which allowed a perfect exposure. He considered that this incision was preferable to a longitudinal incision through the left rectus.

ANALYSIS FOR ONE HUNDRED AND FORTY-EIGHT OPERATIONS FOR GOITRE

DR. CHARLES GORDON HEYD read a paper with the above title for which see page 496.

DR. EDWARD R. CUNNIFFE asked Doctor Heyd how he prepared these goitre patients for operation. The speaker had had some experience with similar cases which he regarded as the most troublesome of all surgical subjects. Two cases had recently come under his care who had been on iodine medication for a period of eighteen and ten months respectively. He withheld iodine for four months and then administered Lugol solution for ten days, at the end of which time he resected one lobe. Eight weeks later he resected the other lobe. Both of his patients recovered, but he was not at all sure that his had been the best way to treat them and asked Doctor Heyd's opinion. Doctor Cunniffe regarded, as the most serious danger in these operations, the possibility of injury to one or both of the recurrent laryngeal nerves. In all large clinics such injuries have occurred; consequently they are not to be passed over lightly. He thought it required considerable courage to use rectal anaesthesia, ethylene gas, or any form of general anaesthesia which prevented the patient from speaking during the operation. If one could recognize the nerve injury immediately through a change in the breathing, it would be safe enough, but the speaker felt that the only sure way in

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which a nerve injury can be immediately recognized is by a change in the voice sound. Therefore, he has for the past three years used local anaesthesia. This form of anaesthesia has given him no trouble even in the most toxic forms of goitre, or in those cases with the most marked nervous symptoms. When using a local anaesthetic, one is able to carry on a conversation with the patient during the entire operative procedure. If the nerve has been injured by a clamp or ligature an immediate change in the voice will give warning and the nerve may possibly be freed of this clamp or ligature, in which case a complete restoration of the function of the nerve will occur in about six weeks. Of course, if the nerve is severed the loss is complete and permanent, but the patient is still protected for one would not then proceed with the remaining lobe lest one might injure the other nerve. Doctor Cunniffe considered local infiltration anaesthesia as an ideal anaesthetic in these cases.

DR. ARTHUR S. MCQUILLAN said one point in Doctor Heyd's classification of goitre had seemed confusing. Why did he subdivide goitre of adolescence as "physiological gland with overfunction"? To the speaker the goitre of adolescence represents a great group, most of which are those of hypothyroidism, a compensatory hypertrophy resulting from too many demands made on a poor quality of thyroid tissue. In his operative cases, classed as hyperthyroidism of adolescence, why distinguish them from the group of Graves' or hyperplastic goitre? In regard to the use of the term thyroxin secretion instead of thyroid secretion: the latter means something more than thyroxin. Kendall claims that thyroxin represents only a fraction of the thyroid hormone. The question of iodine therapy is always unsettled. Many workers report different results, but most report that iodine given for a certain period has its best effect when the patient with Graves' disease has never had it before. But it is rare to find such cases, as most of these patients coming for surgical relief have been taking iodine for months and sometimes for years. They are overdosed and in that type it is generally agreed that iodine has not much beneficial effect. Then too there are cases refractory to iodine from the first. It is a question what to do in such cases in addition to prescribing rest in bed and forced feeding. Then comes the question of ligation and whether that is worth while. Of course everything should be done to bring down the metabolism and so decrease the risk of operation to the minimum. In those severe cases that iodine will not relieve, ligation is indicated and will often bring about the possibility of a safe resection. Another point about which Doctor McQuillan was in doubt was Doctor Heyd's statement that there is an increase of iodine in the blood in cases of severe toxic goitre. Investigation of the presence of iodine in the blood is a very difficult test, for it is there in such small quantities that a large amount of blood must be secured. The results of such a test are not apt to be reliable. In regard to the distinction between Graves' disease and toxic adenoma, Doctor McQuillan agreed with Doctor Heyd that in many respects they are very different clinically. While the majority of cases of

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Graves' disease are acute, some come on mildly and slowly. Most of the adenoma cases will give a history of a nodule for months or years with only recent toxic symptoms. In regard to the convalescence in goitre cases, especially Graves' disease, many do well, or it seems so because very soon after operation the heart rate becomes slower and the patient has an almost normal basal metabolic rate. The question is how well can he stand his work and the ordinary stress and strain of life? It has been Doctor McQuillan's experience that it takes about two years for the patient to become strong enough to work without fatigue. Very often his ordinary work tires him and he has a rapid heart or some other similar symptoms. Iodine is beneficial during this period. In many cases there will be signs of hypothyroidism and a low basal metabolism, and still the pulse will be rapid. In that group many benefit by thyroid feeding instead of iodine. In regard to anaesthesia, the speaker agreed that the use of ethylene is best. Doctor Heyd had reported a series of cases in which sodium amyntal had been used. The speaker had had only one experience with it. His patient was ideal for the use of amyntal and the effect was all that could be desired until four hours post-operative when she took a serious turn with a sudden partial respiratory paralysis requiring artificial respiration. Eventually she recovered, but had a very stormy time for two or three days. In regard to post-operative trachitis, Doctor McQuillan had noticed that skinning off the trachea very closely produced distressing symptoms. He rather doubted the wisdom of leaving thyroid tissue on the trachea as it is apt to grow and cause a nodule to form. If in dissecting, one can keep between the pre-tracheal cervical fascia and the true capsule of the thyroid gland, post-operative tracheitis is much less likely to occur. In regard to nerve injuries, the speaker believed they are rather rare in comparison with the number of thyroidectomies that are done. One is most apt to injure the nerve in a case in which the nerve has been displaced. This happens in adenoma cases where a small amount of thyroid tissue exists between the trachea and the nerve, throwing the nerve out of position. Many cases of nerve injury occur by attempting haemostasis blindly, either including too much thyroid tissue in a clamp or by working in a pool of blood. There is no reason for the latter as haemostasis can be always temporarily controlled by pressure. Doctor Heyd deserved congratulation on this series of cases which represented very careful work not only on his part, but also on the part of his assistants. If there is any branch of surgery which is not a one-man job, this of the thyroid is the one, for so much depends on the anaesthetist and the assistants. Team work makes for the safety of the thyroid patient, but in spite of refined methods of surgical technic, and the controlling action of iodine, thyroid surgery is not at the present time divorced from many hazards.

DR. WILLIAM BARCLAY PARSONS, JR., said that in his experience iodine was useful as a pre-operative preparation in both exophthalmic and toxic adenoma cases. As a rule, the improvement in the exophthalmics was more marked, probably due to the fact that the degree of hyperthyroidism in

ANALYSIS OF OPERATIONS FOR GOITRE

these cases is greater than in those due to so-called toxic adenoma; but qualitatively as the hyperthyroidism is identical in both groups, the reaction, though differing in amount, will be identical in nature. There was a wide difference in opinion as to whether iodine causes hyperthyroidism in a simple adenoma. The speaker had never as yet been able to persuade himself that iodine has ever made an active or inactive thyroid worse. Cases where this was apparently so were due to coincidence or to persistence of symptoms after the wearing off of a temporary effect by the iodine, and were not caused by the iodine itself. He considered it inconsistent and illogical to regard the same drug as able one day to make a patient worse and a few days later to make him better. He felt that it should not be used at all in cases of simple adenoma, as it does them no good, and this practice is apt to lead to the indiscriminate use of iodine, which is particularly bad in cases of hyperthyroidism at other times than the pre-operative period.

DOCTOR HEYD rejoined, in reply to Doctor Cunniffe's criticism, that there were a fair number of patients who had hyperthyroidism for many years. These patients were elderly, had chronic cardio-vascular disease, chronic Bright's disease, and the majority of them had been taking iodine in rather large dosage. These patients could not be prepared before operation in any noteworthy degree. The series just presented was an analysis of 148 operations for goitre and was not intended to be a dissertation on Graves' disease. It was always felt that it was wise to take every case coming in that needed surgery and do the best that was possible for it. It is interesting to note that during the time this series was run there were more deaths from hyperthyroidism, while waiting for surgery, than there were from operative intervention. Furthermore, none of the cases in the series had been operated on under local anaesthesia for the simple reason that in a properly conceived technic the recurrent laryngeal nerves should be neither exposed nor subjected to direct trauma. It was a firmly established belief that when one was in juxtaposition to the nerves and there was the possibility of their injury that the patient would give unmistakable evidence in change in breathing sounds. Doctor Heyd had seen a number of thyroidectomies under local anaesthesia, particularly abroad, and his reasoned conclusion was that it was inimical to a patient with severe hyperthyroidism to have a prolonged operation under local anaesthesia, at the conclusion of which the patient could phonate as well as before the operation, but was in a state of physical and mental collapse. Again, most of the nerve disabilities occurred some time after the operation and were due to factors that could not be prevented by the administration of a local anaesthetic. In regard to the criticism of Doctor McQuillan, adolescent hyperthyroidism was listed purely for a clinical convenience. A great many young children with basal metabolism of plus 12 to plus 14 showed the clinical evidence of a beginning hyperthyroidism. The majority of these patients had the stigmata of an incomplete physical development and, in

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addition, showed faulty habits of living and poor physical hygiene. By the removal of tonsils, clearing up of infections and rest, most of these patients recovered and were listed as simply a functional hypersecretion. A few, however, passed on into well-defined cases of Graves' disease and these were termed adolescent hyperthyroidism. In Graves' disease, it was felt that the introduction of iodine as a pre-operative measure for a week or ten days before operation accomplished as much as had ever been done by ligation. One could enter into an endless discussion as to the merits and demerits of iodine, but this was not the time for it. Doctor McQuillan had questioned the statement, "There is an increase of iodine in the blood in cases of Graves' disease." This is based upon the work of Reid Hunt. A discussion of the subject will be found in the *Journal of the American Medical Association*, 1907, vol. xlix, pp. 1323-1329. Further authority is found in a paper by Charles H. May, in *Surgery, Gynecology and Obstetrics* for April, 1912, p. 365, where the following statement appears: "Less iodine is found in colloid goitre than in the normal when both are compared bulk for bulk. In exophthalmic goitre the iodine is decreased below that of the normal, and Reid Hunt has shown that in hyperthyroidism it is present in excess in the blood." As to the results of operation, it was Doctor Heyd's opinion that the chronic hyperthyroidism of Graves' disease type was never 100 per cent. cured, no matter what was done for it. While the patient subsequently enjoyed relatively good health and the basal metabolic readings would be normal, there was always a tendency to tachycardia and emotional disturbance. In regard to anaesthesia, ethylene was believed to be the anaesthetic of choice *par excellence*. Rectal anaesthesia was also very useful, the only objections to its employment being that it requires considerable detailed preparation; it is a time-consuming procedure, and the operator has to wait upon the details of the anaesthesia. To have an eight thirty A.M. operation under rectal anaesthesia means that the nurses and anaesthetist must begin preparing the patient above five A.M. Most hospital authorities object to this early starting. Doctor Heyd could not quite understand Doctor Parson's philosophy of iodine in goitre. His own experience suggests that iodine is the greatest aid he knew of as a preliminary to operation in Graves' disease. The unfortunate thing about the giving of iodine in goitre has been its wholesale administration by the profession and self-medication by the laity. It is an outstanding exception to have a patient come to the Goiter Clinic with a goitre who has not had iodine. Doctor Smith raised the question that according to the tables submitted in to-night's essay, the pre-operative treatment averaged only four days. This is true in the cases analyzed, but it does not hold true in the Graves' disease cases where the average pre-operative period was approximately seven days. The four-day period was obtained, of course, by the dilution represented in the colloid goitres. When the operator stated that he removed two-thirds or four-fifths of either the right or left lobes of the thyroid gland he was using relative terms. It was the operator's reaction to the size of the thyroid

ANALYSIS OF OPERATIONS FOR GOITRE

lobe and his own opinion as to how much to remove. The removal of adequate amounts of thyroid and, at the same time, not too much was a fine decision and one in which any conscientious operator could err on the side of safety. As to his experience with amyntal while it has not been extensive it has been used in a fair number of cases. In only one case, however, was any dosage used sufficient to obtain complete general anaesthesia. This was in a patient with carcinoma of the thyroid, whose calculated anaesthetic dose was 1.4 grams. When the patient had received 200 milligrams intravenously she went to sleep and received in all 1.2 grams of amyntal. She was totally unconscious and fully analgesic and a complete bilateral thyroidectomy with removal of the isthmus was carried out without the addition of any other anaesthetic agent. The other cases received from 0.8 to 1.0 grams, sufficient to produce complete unconsciousness; the patients were then removed from the ward, or private room, to the operating room and ethylene anaesthesia administered. The intravenous injection of amyntal appeared safe and accomplished all that was previously obtained with rectal anaesthesia, namely, complete unconsciousness, and no memory upon the part of the patient of any of the procedures from the time the amyntal was started intravenously, until three or four hours after the completion of the operation.

BRIEF COMMUNICATIONS

CARCINO-SARCOMA OF THE THYROID

AMONG the mixed tumors of the thyroid are those of special interest which present both kinds of malignant growth, carcinoma and sarcoma.

There are two possibilities: Either the two tumors are developed in different parts of the organ or they are more or less closely mixed. An example of the former type is given in the case of Saltikow, who found carcinoma in one lobe of the thyroid and sarcoma in the other. Both tissues met in the isthmus.

These cases are extremely uncommon. Generally carcinoma and sarcoma are interwoven, sometimes very closely. Schupiser calls this type of carcino-sarcoma "Collisions tumor" and distinguishes it from the "Compositions tumor" in which the two kinds of malignant tissue are more or less mixed.

The question arises: Are sarcoma and carcinoma etiologically independent from each other, or does the existence of one of them provoke the development of the other?

Simmonds believes that both kinds of blastoma are due to the same unknown cause and that regarding their etiology they are independent from each other.

The majority of the pathologists think, however, that either the presence of the sarcoma causes a malignant change of thyroid epithelium into carcinoma or that the presence of the carcinoma leads to a change of the stroma into sarcoma. In spite of the fact that in the greater number of cases the sarcoma is predominant in mass, only Saltikow maintains the idea that sarcoma is the primary growth, which later causes the development of carcinoma. All the rest of the authors, *e.g.* Schupiser, Albrecht, and Herxheimer, cling to the opinion that originally carcinoma develops and later sarcoma. Several case reports and especially experimental cancer research seem to confirm this conception.

Of the case reports, we have one by Schmorl, in which a suspicious adenoma of the thyroid was removed. Recurrence took place in the way of a carcino-sarcoma. On death of the patient, sarcoma only was found in the second recurrence with metastases in the fascia, lungs, liver and kidneys.

Wells reports a case of carcino-sarcoma in the thyroid of a dog. In the metastases he found pure carcinoma in the cervical glands while the kidney, heart, and intestines showed pure sarcoma. In the lungs, however, most of the nodules were found carcinomatous; but some contained both types of growth, just as it occurred in the primary tumor.

Georg Schöne found a carcino-sarcoma in the thyroid of a dog, and metastases of a spindle-cell sarcoma in the lungs.

CARCINO-SARCOMA OF THE THYROID

Nassetti describes a case of carcinoma of the thyroid which returned as a pure spindle-cell sarcoma.

Of the greatest importance are the observations of Ehrlich and Appolant in experimental mouse cancer. These workers transplanted mouse carcinoma from generation to generation. In the thirteenth generation they found a spindle-cell sarcoma, to their great surprise. Upon reexamination of former specimens, they were able to demonstrate carcino-sarcoma in the tenth, eleventh, and twelfth generation. In the thirteenth generation only a few carcinomatous islands were left. In the fourteenth generation the cancer had disappeared entirely, and the tumor continued to be a sarcoma in over fifty generations.

In another experiment the carcinoma also changed into carcino-sarcoma, but the carcinomatous tissue never disappeared and the tumor continued to

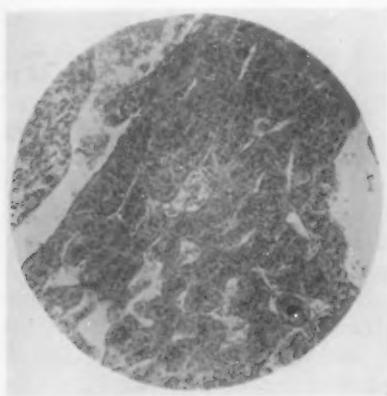


FIG. 1.—Carcinoma.

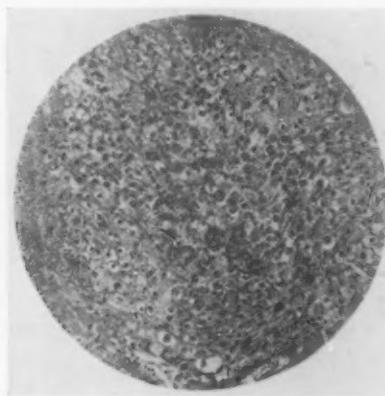


FIG. 2.—Sarcoma.

be a carcino-sarcoma through all generations during nine months of observation.

A third set of carcinomatous mice showed at first intense degeneration of the carcinoma; then from the fortieth generation intense development of the stroma. Suddenly in the sixty-eighth generation, after two and one-half years had elapsed, a typical carcino-sarcoma occurred.

Occasionally a few cancer alveoli were found in the next generations but soon the cancer cells disappeared entirely and pure sarcoma continued.

Appolant lays special stress upon the fact that the sarcomatous tissue is always in the periphery. He is not in accord with Kronpechner's belief that the change from epithelial tissue into sarcomatous tissue is possible.

CASE REPORT.—White male, aged seventy, noticed a slight swelling of his thyroid gland about six months previous to entering the hospital. For three months he had some difficulty in swallowing and breathing. He did not notice other symptoms of any importance, but he felt a certain increase in nervousness. He had lost about twenty pounds in weight in the past two years, and perhaps half of this in the last six months. The thyroid gland was firmly fixed and extended from the point of the chin to five centimetres below the clavicle and laterally from the sternocleidomastoid almost to the level of the lower border of the ear.

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A tumor the size of a cocoanut, weight 470 grams, was removed by Dr. O. R. Lillie. After an uneventful recovery, the patient left the hospital eleven days after the operation. He went to Michigan where he died of a recurrence three months later. No post-mortem examination has been made.

Gross Description.—The tumor was surrounded by a capsule and easily shelled out. It was of very solid consistency and in one area about the size of a dollar the tissue was softened and of yellowish color. The rest was of grayish-white color and did not look like thyroid gland. The tumor was composed of different nodules which could not well be separated from each other because of interlacing fibres.

Microscopically there were remnants of the proper thyroid tissue in a few sections, with alveoli lined by a cuboidal epithelium and containing a normal amount of colloid. Fig. 1 shows strands of epithelial cells. They are irregular in size and shape and the nuclei hyperchromatic. Although the structure of the cells resembles the epithelium of the thyroid gland, there is no formation of distinct alveoli and no colloid. In other slides (Fig. 2) there is a remarkable change of these epithelial cells. They are much

larger, both the nuclei and cytoplasm being increased. The nuclei are dark, hyperchromatic and show more mitoses than in Fig. 1. The cytoplasm is extremely clear, vesicular and sometimes the nucleus is pushed to one side and becomes sickle-shaped. The grouping in strands has disappeared and the cells form one solid mass.

Bassal and Rigaud have described in their paper a case which presents exactly the same structure of the cells as my case.

In Fig. 3, we see at "A" the same solid strands as in Fig. 1, and at "B" the same vacuolated cells as in Fig. 2. Between these two groups we find irregular spindle-shaped cells which show many mitotic figures. They are polymorphous. In other sections they are grouped in irregular whirls, spindle-shaped and round-shaped cells alternating.

Examining a large number of sections, I found in the majority of them sarcoma only, and no carcinoma. The sarcomatous tissue was in many areas entirely necrotic.

An absolute proof of the malignancy of the blastoma was given by the invasion of many blood-vessels by strands of cancer cells.

Summary.—A case of carcino-sarcoma of the thyroid has been observed. The two tissues were intimately interwoven, the sarcoma being by far predominant and showing extensive necrosis.

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REFERENCES

- Albrecht: Verhandl. der deutschen patholog. Gesellschaft, vol. xii, p. 72, 1908.
Bassal et Rigaud: Archives de médecine expérimentale, vol. iv, p. 491, 1913.
Ehrlich and Appolant: Arbeiten aus dem kgl. Institut f. exp. Therapie, p. 1, 1906.
Robert Kunschik: Zschr. f. Krebsforschung, vol. xxiii, p. 416, 1926.
Nasetti: Polyclin., 1909.
Saltikow: Cbl. f. Path., vol. xvi, p. 547, 1905.
Schöne: Virchow Archiv, vol. cxv, p. 169, 1909.
Schupiser: Zschr. f. Krebsforschung, vol. xxi, p. 19, 1923.
Simmonds: Zschr. f. Krebsforschung, vol. xiii, p. 307, 1913.
H. Gideon Wells: Jour. of Path. and Bacteriology, vol. vii, p. 357.

XANTHOSARCOMA

XANTHOSARCOMA

VERY thorough studies about xanthoma have been given in the work of B. van den Hartog, Francis Harbitz, Eugen Kirch, and Paul Spiess.

Infiltrations of tissue by cholesterol have frequently been called xanthomata, regardless of whether they were neoplastic growths or not. We classify them into three large groups: (1) pseudo xanthoma; (2) Multiple symptomatic xanthoma (by Aschoff, called xanthelasma); (3) single xanthoma.

(1) Pseudo xanthoma, as the name implies, is not a true xanthoma; however we find in it certain cell groups containing cholesterol esters formed by reabsorption of soft fatty substances. Examples of pseudo xanthoma are found in brain abscess, in the walls of dermoid cysts and gall-bladders, and in pyosalpinx.

(2) Symptomatic xanthoma is found in diabetes and icterus; sometimes it has to be considered as a hereditary condition. In these cases, hypercholesteræmia is always present and is very characteristic for these growths. Furthermore we find, as a rule, multiplicity and instability of the growth, as well as degenerative processes. A typical example is the xanthelasma of the eyelid.

(3) Another large group of xanthomatous growths may be separated from the two former ones by the fact that only one place in the body shows infiltration with cholesterol. Therefore we call them single xanthomas. The great majority of these growths are true blastomas. Only occasionally xanthomatous infiltration takes place in a granuloma (Seyler).

Xanthomatous tissue has been found in fibromata, angioma, and especially in sarcomata.

Cases have also been described in which xanthomatous changes occurred in tissue of epithelial origin. Dub found xanthomatous cells in carcinoma of the fundus uteri, and Kinoshita described xanthomatous carcinoma of the prostate. It is remarkable that xanthocarcinomas always develop in tissues which already contain cholesterol under physiologic conditions.

A relatively common xanthomatous blastoma is the sarcoma. We can distinguish two groups, xanthosarcoma of the extremities and xanthosarcoma of other localization. The latter are very rare. Examples have been described in the suprarenal gland, the tongue, parotid, labium, ileum and in the thoracic cavity.

It is of practical value to separate these xanthosarcomata from those of the extremities because the former are always malignant, while the latter never form metastases and only in extremely rare cases (as in the case of Beneke) show invasive growth.

Spiess distinguishes two histological types of xanthosarcoma of the extremities. In one there are many blood vessels surrounded by polyhedral cells as an outstanding feature. In the other type giant cells apparently of the osteoclast type predominate. We call the former type angiomatic, the latter giant-cell type.

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It was a strange coincidence that I found two cases of xanthosarcoma in one week, one of them representing the angiomatous type and the other the giant-cell type. Both tumors were also interesting on account of their localization. It is well known that the most frequent localizations of xanthosarcoma in the extremities are the fingers, the hand, the toes, less frequently the foot and the forearm. The most uncommon localization is in the leg. The two xanthosarcomata which will be described in the following case reports were both localized in the leg, one of them in the thigh, close to the fascia, and the other in the deep fascia of the popliteal space.

CASE I.—H. L., white, male, age fifty years, gave a history of having a tumor of the thigh for some years. It lay free, medial and posterior to the femur between the lateral and posterior groups of muscles. The growth was shelled out and removed by Dr. C. H. Evans without difficulty. Grossly it showed a marked nodular



FIG. 1.—Xanthosarcoma.

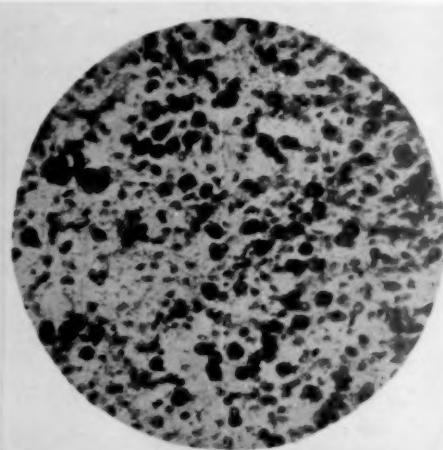


FIG. 2.—Xanthosarcoma.

structure. One of the largest of these, the size of a hen's egg, was of soft consistency and gelatinous. Another, the size of a plum, was more firm and showed many haemorrhages. The remainder of the growth consisted of many small nodules of firm consistency.

Microscopically all the nodules showed the same structure, the only difference was a varying amount of oedema of the stroma. Studying the slides with low power (Fig. 1), there are many blood vessels surrounded by polyhedral cells varying in size and shape and imbedded in a dense network of fibrous tissue. Observation with high power makes the irregular character of the cells appear more striking and besides this the so-called foam cells with eccentric nucleus and large vacuoles are noticed. Frequently the nucleus is pushed to the side to such a degree that the cells present the form of a signet ring. When a fat stain is used, for instance Sudan iii (Fig. 2), we are able to prove that the contents of all these vacuoles consist of a fat-like substance. In some cells there are small droplets separated from each other, in others they fuse into one large drop.

In this case it was not possible to find any haemosiderin with the Prussian blue reaction.

CASE II.—J. B., white, female, age twenty-nine years. A tumor had been present in the left popliteal space for seven years. It never caused any pain and grew

NON-ROTATION OF COLON

gradually. The tumor was the size of a large lemon and extended down to the deep fascial layer and was removed with some difficulty by Dr. T. S. O'Malley.

Grossly the tumor showed an irregular outline and presented a nodular structure. The average size of the nodules was that of an olive. They had a consistency of cartilage and cut readily with a knife. The cut surface showed bluish-white areas and a meshwork of yellow streaks.

Microscopically (Fig. 3) we find polyhedral and spindle-shaped cells imbedded in hyaline stroma. In addition there are giant cells containing more than twenty nuclei apparently of the osteoclast type. Furthermore we see many foam cells of the same type as in Case I. There are different stages of foam-cell production: in the beginning small droplets appear in the cell, later on the cell being decomposed, large drops are lying in the stroma.

Examination with the Prussian blue reaction showed a large amount of pigment.

Cholesterol determinations were impossible because of the inability to obtain blood specimens from these patients after operation.

SUMMARY

(1) Two cases of xanthosarcoma have been reported: One of the angiomatic type showing many blood vessels, and one of the giant-cell type.

(2) Both tumors took their origin from the lower extremity; one from the fascia of the thigh, and the other from the fascial layers of the popliteal space.

(3) In both cases distinct foam cells were present. The fat could be stained with Sudan III and osmium. In only one case haemosiderin could be demonstrated by the Prussian blue reaction.

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REFERENCES

- Dub, Irmgard: Zbl. f. allg. Path., vol. xxiv, p. 145, 1923.
Harbitz, Francis: Norsk Magazine f. Laege videnskaben, vol. Ixxxvi, p. 322, 1925.
Harbitz, Francis: Archives of Path., vol. iv, p. 507, 1927.
Kinoshita, M.: Ztschr. f. urologie, vol. xiv, p. 193, 1920.
Kirch, Eugene: Ziegler's Beitrage, vol. lxx, p. 75, 1922.
Seyler: Virch. Arch., vol. cxxxxix, p. 20, 1923.
Spiess, Paul: Frankf. Ztschr. f. Path., vol. xxiii, p. 471, 1920.

NON-ROTATION OF THE COLON

THE following case is reported because of the rarity of the anomaly; and second, because of the unusual symptoms manifested.

CASE REPORT.—White, male, age twenty-seven years, was first seen by me July 17, 1928. His complaint was pain in the left side of his abdomen, associated with attacks

BRIEF COMMUNICATIONS

of diarrhoea. He stated that he had never been well; that from infancy he had had some form of stomach trouble; and that as long as he could remember he had had frequent attacks of cramping pains in the left side of his abdomen, associated with diarrhoea. He described the pain as cramping in character, and radiating from the umbilicus downward toward the left. The pain had always been worse immediately following his meals, and in the early morning hours. The attacks of diarrhoea came on from thirty to forty minutes after his meals and persisted until he had had from two to four bowel movements. Following these short attacks of diarrhoea he was fairly comfortable until following

his next meal, when he experienced the same type of pain, associated with diarrhoea. He had been treated from time to time by various physicians without relief (treatment usually being directed toward a correction of his diet). Following an examination one month before consulting us, he was told that his appendix was on the left side, but that it had no bearing on his condition.

The physical examination revealed nothing of special interest, except the fact that he was greatly reduced in weight, his weight at the time being eighty-seven pounds, with a height of five feet, four inches. The entire abdomen was more or less spastic to palpation, but there were no special points of tenderness and no masses were felt. Examination of urine was negative, and repeated examinations of his stool were negative for intestinal parasites, or evidence of pancreatic insufficiency. Blood examination was negative, except for evidence of a mild secondary anaemia. His blood Wassermann was negative. X-ray and fluoroscopic study done July 18, 1928, showed the stomach to be normal. The colon, as shown in Fig. 1, was as follows: "Twenty-four-hour examination shows meal in colon from caecum to rectum, with some residue in terminal ileum, which appears to be adhered on the right side, just above the



FIG. 1.—Non-rotation of the entire colon. Fluoroscopic study shows the cæcum, ascending and transverse colon adhered together.

crest of the ileum. The terminal ileum seems to be emptying into the cæcum from the right side. The entire colon is to the left of the median line, and the cæcum, ascending, transverse and descending colon appear to be adhered together. The appendix is patent and appears to be fixed in the mid-line."

Impression.—In view of the fact that patient had had adequate medical treatment without any appreciable improvement; that repeated stool examinations were negative and that there was definite fluoroscopic and X-ray evidence of an anomaly of the colon, it was reasoned that the condition might be mechanical, and could probably best be dealt with by an attempt at correction of the anomaly.

Operation under gas-ether anaesthesia, July 23, 1928. Through a long right rectus incision, the abdomen was opened and the condition found was as described in Fig. 2.

NON-ROTATION OF COLON

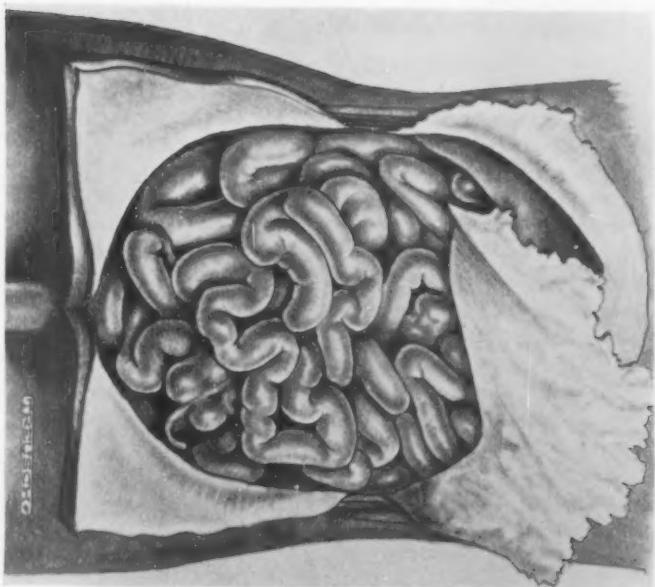


FIG. 2.—The small intestine is rotated in front of the colon and fills the right side of the abdominal cavity. Only the tip of the cæcum and appendix are seen.



FIG. 3.—The small intestine has been rotated to the left, exposing the cæcum, ascending, and a portion of the transverse colon. This is to the left of the median line, and is adhered together, and to portions of the jejunum and ileum by bands of adhesions. This portion of the colon is without a mesentery; the duodenum and head of the pancreas have no peritoneal covering.

BRIEF COMMUNICATIONS

There was a partial non-rotation of the transverse, ascending colon and cæcum, and with the exception of the cæcum, the colon was hidden from view by loops of the small intestine which had rotated in front and to the right, filling the right side of the abdominal cavity. When the small intestine with its mesentery was rotated to the left, the cæcum, ascending colon, and part of the transverse colon was found to be firmly adhered, by a thin membrane, to the duodenum and portions of the jejunum, and was without a mesentery. Its blood supply was derived from a large artery and vein which appeared to correspond to the mesenteric vessels. They came off directly from the abdominal aorta and inferior vena cavae, making contact about the middle of the transverse colon. They coursed along the transverse, ascending colon and cæcum close-adhered to the bowel, giving off arterial and venous branches. We were very confused and uncertain as to the nerve supply, but in the absence of a mesentery, it was assumed that the nerves accompanied the vessels, and had the same distribution. A portion of the duodenum was entirely extra-peritoneal, as shown in Fig. 3.

It was seen readily that the anomalous vessels were of sufficient length to allow the colon to be rotated to its normal position, provided it could be successfully freed from the duodenum and loops of small intestine. This was eventually accomplished; after which the colon was rotated into its normal position, and a colopexy was done (Coffey's technic). Following this, the raw surfaces were repaired and the abdomen closed in layers with one cigarette drain placed in the right iliac fossa.

Post-operative Course.—For the first seventy-two hours following operation, tympanites was very troublesome, but with this exception convalescence was uneventful. The wound healed without infection, and he was dismissed from the hospital on the twentieth post-operative day.

Subsequent Course.—Since operation, which is now approximately one and one-half years, patient has steadily gained in weight, and now weighs 138 pounds. He has had no return of abdominal pain or attacks of diarrhoea. An X-ray study of his colon, done September 9, 1929, shows meal in colon from cæcum to rectum. A part of the barium meal has been evacuated. Cæcum and ascending colon are in their normal positions on the right side of the abdomen; no pathology is demonstrated.

Comment.—From the operative findings and from the subsequent course of this case, it is fair to assume that the diarrhoea was due entirely to mechanical causes. As soon as peristalsis was set up in the duodenum and jejunum, following the intake of food, there was sufficient irritation produced in the cæcum, ascending and transverse colon to precipitate the evacuation of the bowels, resulting in the peculiar attacks of diarrhoea which always followed his meals.

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ACUTE PRIMARY ILEOCOLIC INTUSSUSCEPTION IN THE ADULT

THE rarity of acute primary ileocolic intussusception in the adult warrants the report of this case. It is distinctly a disease of infancy or childhood; over 80 per cent. occurring during the first two years of life and less than 5 per cent. after puberty, and of this 5 per cent. practically all have been due to tumors or foreign bodies within the lumen of the gut, or were of the chronic or recurring type. In a review of the literature only three cases of acute primary ileocolic intussusception in middle life were found.

ILEOCOLIC INTUSSUSCEPTION IN THE ADULT

It is probable that it is sometimes overlooked because of its infrequency. Missing the opportunity of seeing the patient at the onset, failing to diagnose early, and to operate immediately thereafter, results in a fatal outcome. Gangrenous areas of the intestinal mucosa produce toxins which affect the cells of the central nervous system, absorption of sufficient amounts producing death within five or six days. The real danger is the delay of prompt surgical intervention.

CASE REPORT.—B. H., fifty-three years, male, white, married, road supervisor. Family and personal history negative. Habits regular. No history of any previous attacks of colic, or indigestion. Healthy, industrious, outdoor worker. While supervising road building, had sudden, severe pain in mid-abdomen at 2:00 P.M., June 22, 1929; immediately vomited food eaten two hours before. This was his usual dinner and had not hitherto disagreed with him. He was rushed to the nearest physician two miles away, who administered a hypodermic of morphine, and as no relief was obtained from the paroxysmal pain, repeated the hypodermic in thirty minutes. When these had failed to relieve him, he was hurried in an automobile to Selma twenty miles away. The vomiting was relieved after the hypodermics, but the severe abdominal pain, lasting from five to ten minutes, recurred at approximately thirty-minute intervals. When he

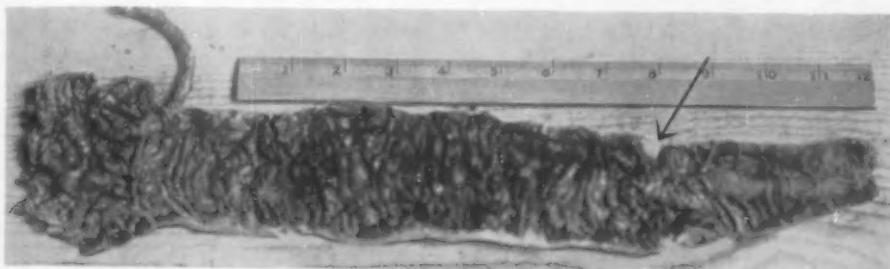


FIG. 1.—Mucous surface of resected gut. Arrow points to small enlarged Peyer's gland.

arrived in Selma, he was seen immediately by a physician, who gave him a hypodermic of morphine, and an enema, which was followed by a good bowel movement but with no abatement of his recurring paroxysms of pain. He was seen by my associate, Doctor Doherty, seven and one-half hours after the onset. At that time, his appearance was rather typical of acute appendicitis, as this visit found him in the interval between his paroxysms of pain. His abdomen was rigid; moderately tender on pressure over the right iliac region; absence of tumor or mass on deep palpation, complaining of nausea but no vomiting; pulse 80, temperature 97. The three hypodermics of morphine doubtless had masked the symptoms. Immediate operation was advised and he was admitted to the Vaughan Memorial Hospital two hours later, arriving in a paroxysm of severe abdominal colic, crying out noisily from the pain, for which a hypodermic of morphine $\frac{1}{8}$ of a grain, and hyoscine $1/300$ of a grain was given.

Physical examination at this time showed a well-nourished man, shocked, pale, perspiring and suffering intensely. There was general abdominal rigidity with distension, no intensification of pain on pressure over McBurney's point, but on deep palpation, beginning in the upper right iliac region and extending along the ascending colon, a mass could be detected in spite of the abdominal rigidity. The physical examination was otherwise negative. The blood count showed: Haemoglobin 80 per cent.; red blood cells 4,200,000; white blood cells 13,300; polymorphonuclears 60 per cent.; small lymphocytes 24 per cent.; large lymphocytes 10 per cent.; eosinophiles 2 per cent.; transitionals 4 per cent. The urine examination was negative.

The presence of a mass this early after the onset of symptoms with recurring parox-

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ysmal pain unrelieved by a grain of morphine given hypodermically in divided doses; the subnormal temperature, evidence of shock, an increased leucocytosis with a low polymorphonuclear count was not so characteristic of appendicitis as of intestinal obstruction. Additional evidence was obtained from a rectal flushing, the water returning clear containing a quantity of mucus, which, however, was not blood stained. A pre-operative diagnosis of intestinal obstruction was made.

At midnight the operation was begun under local anaesthesia; the abdomen was opened through a right gridiron incision rather higher than usual for an appendectomy; the mass was exposed and the appendix found with considerable difficulty, its base being pulled into the cæcum and the terminal ileum over-riding it; on inspection the appearance was that of a retrocolic hernia. By enlarging the abdominal incision upward, the true condition was demonstrated, as the ileum was seen to be invaginated along with a portion of the cæcum into the ascending colon. In attempting reduction by traction on the invaginated intestine, the pain was so intense that it was found necessary to etherize the patient. The force of the traction necessary to reduce the invagination was so great, even with manipulation from above, that it was feared the gut would be pulled in two or torn. The intussusception consisted of 16 inches of the terminal ileum, with a portion of the cæcum including the base of the appendix; the gut was dark with many thrombotic areas. The terminal ileum and cæcum were almost black in color. No gross pathology was observed in the examination of the reduced intestine. An enlarged Peyer's gland was in the ileum, more than one inch above the invaginated portion. The application of hot gauze pads for fifteen minutes was not followed by sufficient restoration of circulation to justify leaving the gut within the abdomen, as evidently portions of it would become gangrenous and slough. A resection was done, including all the darkened portion of the bowel consisting of the cæcum and 16 inches of the terminal ileum, including the appendix. A lateral anastomosis was made between the ileum and ascending colon $2\frac{1}{2}$ inches above the point of resection of the cæcum. As a measure of additional safety, an enterostomy was done after the Mayo-Long method in the ileum, about 10 inches from the point of anastomosis; the abdomen was closed without drainage. Five hundred cubic centimetres of 15 per cent. glucose in a physiologic salt solution was given intravenously while the patient was still on the operating table. He was returned to his room, pulse 92, respiration 16, and was given immediately a clyster of 1 quart of plain hot water, which he retained. This was repeated after rectal flushing every six hours. The intravenous glucose was again given in seven hours, at which time his pulse was 90, respiration 20, temperature 98.3. He voided 6 ounces of urine, and thereafter in sufficient quantities. Rectal flushings returned colored and with lots of flatus; drainage from the enterostomy tube was free, temperature varying from 99 to 101.5. General condition continued very satisfactory, except that his skin was cold and clammy, with rather free perspiration, till the evening of the third day, a sudden severe pain in his abdomen and hiccough became persistent. The morning of the fourth day, he complained of a sense of fullness, his upper abdomen being markedly distended. On introducing a stomach tube, 2 quarts of coffee-colored fluid was withdrawn; two hours later he vomited a quantity of dark liquid. Peristaltin and pituitrin were given hypodermically, clysters of epsom salts, repeated gastric lavage, flushing of enterostomy tube and rectum, all without resulting improvement; the acutely dilated stomach, progressive ileus, and an extremely sick man caused us to do a second and higher (jejunal) enterostomy on the left mid-abdomen. Following this, the dilated stomach and ileus disappeared, the hiccough stopped, an abatement of symptoms with very free drainage of intestinal contents through the recent enterostomy opening; the improvement was temporary; he began losing from the excessive drainage through the high enterostomy opening, progressive and rapid emaciation ensued. The left enterostomy opening was closed after draining two weeks. His recovery from the profound inanition and attendant neurosis was very slow. His hospitalization lasted eleven weeks. The progress to complete health at the time of this report is gratifying.

ILEOCOLIC INTUSSUSCEPTION IN THE ADULT

Pathological Report.—*Gross Description.*—The specimen consists of a strip of intestinal wall 3 centimetres in length, 0.8 centimetres in greatest thickness.

Microscopic Description.—Sections show small intestine with a large mass of lymphadenoid tissue extending from the mucosa to lower submucosa. The mass consists of many more or less distinct follicles so that the structure is that of a Peyer's patch. The central germinal region of the follicles is well preserved in most cases, but its cells are large and there is not the usual differentiation of cortical and central germinal-cell types. The supporting fibrous tissue columns are diffusely infiltrated by many large cells of lymphoblast type. Both here and within the follicles there are many mitotic figures. There are frequent large-cell forms but no cells of the Reed type. The lymphoblastic cells extend irregularly through connective tissue about the base of the lymphadenoid tissue. With them are many plasma cells and eosinophiles. There is slight fibrous tissue increase at this zone. A few cells extend also into the muscular layer and reach the serosa. There are occasional small interstitial haemorrhages and occasional cells contain granules of blood pigment. The mucosa is haemorrhagic and over middle of tumor mass it is ulcerated.

The lesion may be regarded as early lymphosarcoma. The numerous mitotic figures present may be only an inflammatory phenomenon but their distribution leads one to regard them as evidence of malignancy (Graham). *Microscopic Diagnosis.*—“Lymphosarcoma of Intestine.” “The condition is one of a lymphosarcoma, which is not an unusual neoplasm to spring from the intestine.”—(Lanford.)

Comments.—Certain outstanding procedures appear to have been essential in the successful outcome of this case. 1. Early diagnosis and operation ten hours after onset. 2. Resection of traumatized and toxin-forming intestine, including unsuspected sarcoma of Peyer's patch. 3. The two enterostomies, one in the ileum at the time of operation; the second in the jejunum, after the onset of acute dilatation of the stomach and ileum. 4. Closing the second high enterostomy opening when progressive and rapid inanition became apparent. 5. Intravenous saline and glucose given repeatedly, combating dehydration. 6. Frequent flushings of the intestine through rectum and enterostomy tube removing toxic contents. 7. Repeated gastric lavage to avoid and to relieve dilatation. 8. Had the invagination been reducible and viable, the unsuspected sarcoma would never have been detected.

Résumé of Cases Previously Reported.—In the review submitted, only three cases of acute primary ileocolic intussusception were found among those reported.



FIG. 2.—Passes through entire specimen showing mucosa covering the edge of the tumor, and below it the muscle. The section is cut on a tangent, and the relationship of the parts is thereby disturbed.

BRIEF COMMUNICATIONS

Two by Moor^o in 1924. These were Mohammedans and both had their onset following a religious fast of sixteen hours. The first, aged forty years, after drinking a glass of water had severe colic and four days later was admitted to the hospital with intestinal obstruction and peritonitis; operation revealed irreducible ileocolic intussusception. Resection, enterostomy, and peritoneal drainage was done; the patient died in twelve hours.

The second, aged sixty years, had violent colic while preparing his meal following the fast. He was admitted to the hospital five days later; operation revealed ileoileal intussusception, which had passed through the ilieocæcal valve, forming an ileocolic intussusception. This was reducible. After reduction, gangrenous patches were found and a perforation at the proximal margin of the constricted ring of the ileum, as a result of gangrene. Resection, enterostomy, and peritoneal drainage was done. The patient died six hours later. In both cases, examination of the resected gut and of the rest of the intestines, at autopsy, revealed nothing in the nature of a tumor of the intestinal wall or of a swelling of Peyer's patches. The length of the invaginated gut was 2 feet

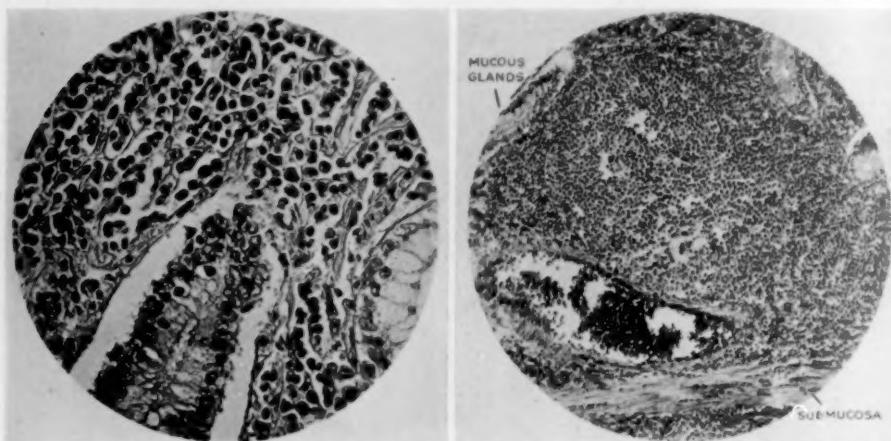


FIG. 3.—The high magnification of the tumor cells surrounding the mucous glands.

FIG. 4.—Tumor nodule in the mucosa, there being noted mucous glands on the surface completely surrounded by growing tumor, which is infiltrating into the submucosa.

in the first and 3 feet in the second case. The remarkable example of the influence of the mind on the motor function of the intestine is emphasized in this report.

The case of Hinton was a man aged thirty-two years. Immediately after eating a piece of cake, he had severe pain, and was admitted to the hospital twenty-four hours after his attack; he gave a history of recurring attacks of abdominal pain, similar to this but less in intensity. On operation, a six-inch intussusception of the ileum, appendix and cæcum was found and reduced. The appendix was removed and the abdomen closed without drainage. No other abnormality of the abdominal viscera was found. The recovery was uneventful.

A study of the literature shows that almost all of the adult cases of intussusception were caused by a tumor, usually pedunculated, within the lumen of the bowel. As a result of peristaltic waves the tumor pulls on the portion of the intestinal canal at the point of attachment, and this disturbance produces a spastic contraction of the bowel over the tumor, and as in spastic conditions of the intestine proximal to the area of contraction, there is an area of relaxation. The downward force of the peristaltic wave pulls a

ILEOCOLIC INTUSSUSCEPTION IN THE ADULT

segment of the gut into this relaxed area and thus begins intussusception due to tumor. A study of the cases where no gross pathology of the intestine is found has given rise to the opinion that vasomotor disturbances reflex in origin, producing spastic and relaxed areas proximal to each other, are the probable causes of primary intussusception. In the three cases in adults herein reviewed a reflex vasomotor disturbance originated in two from the intake of food, and in one from the stimulation of the appetite while preparing food. It is a question whether the one here reported is due to the intake of food two hours prior to onset, or the most probable conclusion from the lymphosarcoma situated in a Peyer's patch. Had this sarcomatous structure been included in the invaginated part of the gut, such a conclusion would be most rational. The fact that it was over an inch above the invaginated segment would cause one to doubt as to whether it was coincidental or causal. The fact that these sarcomata frequently are of very rapid growth would cause one to lean to the hypothesis that this rapidly growing tumor, infiltrating into the muscular coat, caused reflexly areas of spasticity and dilatation; on the other hand the element of doubt enters again as lymphosarcoma is commonly found in this portion of the gut; whereas intussusception in adults is of extraordinary rarity. The fact remains that from either, or both, could come the stimulus of reflex spasticity and relaxation causing intussusception. The symptoms are essentially those of mechanical obstruction, the outstanding feature being sudden and unusual severity of pain at the onset; intermittent in type, accompanied with shock and even collapse, nausea and vomiting, and bowel evacuation without consequent relief of pain. Tumor at the very onset may be absent, but manifests itself as a definite mass within a few hours, appearing much earlier than masses found in attacks of acute appendicitis.

Causes of Death.—"Cannot be ascribed to one factor."

A. Intrinsic. 1. Toxicity of bowel contents above obstruction. 2. Gangrene of obstructed portion with absorption of autolytic and bacteriologic products which exhibit a high degree of toxicity. 3. Dehydration more intense the higher the obstruction.

B. Extrinsic. 1. Procrastination in summoning a doctor. 2. "The tragedy due to late diagnosis." 3. Delayed operation. 4. Inadequate surgery. 5. Insufficient supportive and eliminative treatment following operation.

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REFERENCES

- Hinton, J. William: ANNALS OF SURGERY, vol. Ixxxiv, pp. 100-103, July, 1926.
Lewis, Dean: Wisconsin Med. Jour., vol. xxviii, pp. 195-199, May, 1929.
Mooro, A. W.: The Brit. Med. Jour., No. 3295, p. 319, February 23, 1924.

BRIEF COMMUNICATIONS

A FASCIA-CHECK BAND FOR RELIEF OF PARALYTIC
GENU RECURVATUM*

THE genu recurvatum produced by relaxation or paralysis of the structures on the posterior aspect of the joint is a disabling as well as an unsightly deformity.

A moderate degree of hyperextension at the knee may be corrected by an osteotomy of the femur or tibia, but in the more severe types of paralytic genu recurvatum the osteotomy has the disadvantage of requiring, in order to render it mechanically effective, a greater degree of bony angulation than one desires. So that if the patient with severe hyperextension at the knee desires to retain mobility at the joint, he has ordinarily been fitted with a jointed brace or motion has been sacrificed for stability and arthrodesis performed.

In an attempt to obviate the necessity of using either of these latter methods of treatment, which have obvious disadvantages, it was thought that



FIG. 1.—Showing degree of genu recurvatum before operation.

a rolled fascial strip from the strong fascia covering the outer aspect of the leg might be used to act as a check ligament to prevent hyperextension. Therefore, a strip of fascia about an inch and a half wide was dissected up from the fascia on the outer aspect of the leg and rolled in such a manner as to keep the muscle side out. Then the shaft of the femur was exposed several inches above the joint and this rolled fascial ligament inserted subperiosteally and brought down on the inner side of the knee under the hamstring muscles and imbedded in the posterior internal surface of the tibia.

It was thought that the tendency of this fascial-check ligament to stretch under weight bearing would be minimized if it were secured at the three bony points of contact, head of fibula, shaft of femur, and postero-internal surface of tibia. This method has been done several times on cadavers but upon only one living case and it is realized that no definite conclusions can be made, but the procedure is presented for your consideration. One can, however, say that the deformity in this case, which was done over a year ago, has not recurred under weight bearing, and this in spite of an active quadriceps

* Presented before the alumni of the Hospital for the Ruptured and Crippled, November 26, 1929.

RELIEF OF PARALYTIC GENU RECURVATUM

muscle, and in spite of the extra strain that has been put on the posterior structures of the knee by the foot being in an attitude of equinus following astragalectomy. The history made on admission to the New York State Reconstruction Home in 1928 was as follows:



FIG. 2.—Post-operative photograph showing stability of the knee when the patient is standing on the left leg.

This patient is fifteen years of age and gives a history of having had infantile paralysis at the age of three, which involved both lower extremities. Examination shows that she is in good general condition, presenting no paralysis other than that of the left lower extremity.

She is unable to walk without being supported and presents atrophy of the entire extremity and recurvatum at the knee. On the left side the iliopsoas muscle is paralyzed, the other flexors of the hip appear weak but active. The abductors and adductors appear to be paralyzed. The gluteal extensors are active. The left knee assumes an attitude of extreme recurvatum whenever weight is borne. The quadriceps

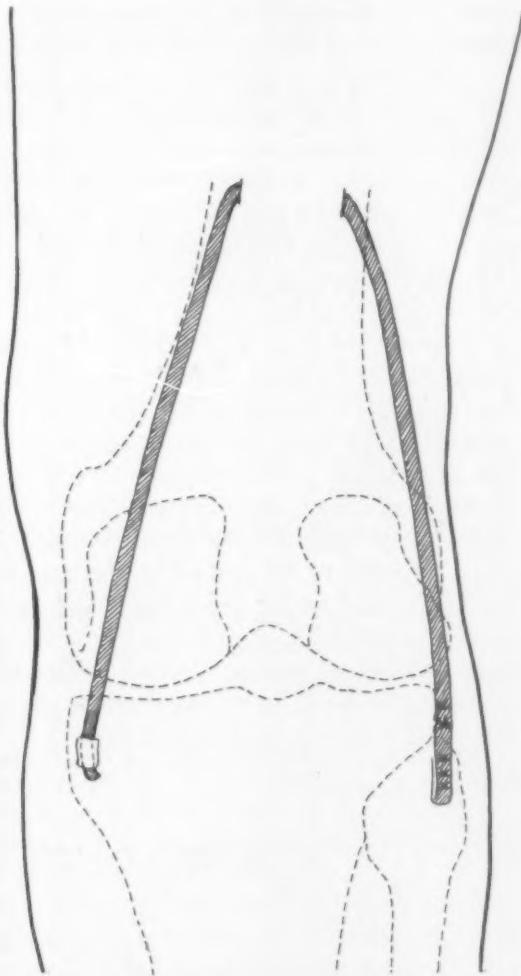


FIG. 3.—Diagram showing the folded strip of fascia attached to the head of the fibula, shaft of the femur, and the condyle of the tibia.

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is weak but the patient is able to actively extend the knee against gravity. There appears to be no power in either group of hamstring muscles. Below the knee the foot is in an attitude of calcaneo-valgus and all the muscles appear paralyzed with the exception of a trace of power in the flexor of the big toe.

On November 7, 1928, this patient had an astragalectomy operation performed on the left foot for calcaneo-valgus. On November 30 the fascial-check operation was performed as follows:

The entire left limb was prepared in the usual manner and the operation performed without a tourniquet. A long incision was made on the lateral aspect extending from a few inches above the knee-joint down to the lower third of the leg, and another incision on the medial aspect extending a few inches above and below the knee-joint. A broad fascial strip from the lateral aspect of the leg was dissected upward. The length of this strip was determined by making it slightly more than twice as long as the distance from the head of the fibula to the subperiosteal tunnel on the shaft of the femur as shown in the diagram. This fascial strip was then carefully rolled, folded upon itself at the level of the head of the fibula and several kangaroo sutures inserted at this point as seen in diagram. Then the rolled fascia was directed subperiosteally across the femur and brought down under the hamstring muscles after which it was sutured to the tibia, while the knee was kept flexed at an angle of about 160 degrees. The wound was then closed in layers and plain catgut used for the skin. Plaster-of-Paris casing applied, extending from the ankle to the groin with the knee remaining in slight flexion.

The wound healed per primam and the patient wore this plaster support six weeks following operation, after which all support was removed from the knee and weight bearing allowed. The security of the joint one year after operation is shown in the photograph while the patient is bearing the entire weight of the body on the left foot.

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PAPILLOMA OF THE DUODENUM*

NEW growths of the duodenum are a most infrequent finding. Balfour and Henderson¹ in a recent paper on benign tumors of the duodenum were able to gather the records of 131 benign growths, so seemingly the mucosa or the secretions have the singular power of restricting the growth of neoplasms. Golden² in a collective review of papillomata of the duodenum was able to assemble the reports of but seventeen cases and added two of his own, bringing the total number to nineteen. The case of benign papilloma reported in this paper is a typical example of a pedunculated papilloma which manifested its presence by severe and repeated haemorrhages and closely simulated an ulcer.

CASE REPORT.—No. 49-951, a woman, age thirty-nine, married, was admitted to my care at Lebanon Hospital October 14, 1925, with the history that about two years ago

* From the surgical service of Lebanon Hospital of New York.

PAPILLOMA OF THE DUODENUM

she began to complain of heartburn which was more or less constant, belching of gas, excessive gas passed per rectum and a feeling of distress in the left lower quadrant, most annoying about four hours after a meal. This uncomfortable feeling was relieved by the taking of bicarbonate of soda and the belching of large quantities of gas.

These attacks would persist for a few days with intervals of complete relief of from one to three weeks and have been progressively getting worse and lasting longer. During all this time the patient has been feeling very weak and tired and constantly falling asleep even while at the theatre.

During the past five weeks the patient noticed that her stools were very dark in color, at times almost black. About two weeks ago the patient became so weak that she went to bed and has remained in bed up to the present time. During the past week she has complained of severe cramp-like pains in the calves of the legs. Has lost six pounds in weight. No vomiting or nausea.

Past history.—Essentially negative. Has never been pregnant.

Examination.—Skin and mucous membranes markedly anaemic. Head, neck and chest essentially negative. The abdomen is rounded and muscles move easily with respiration. On light palpation there is very slight muscular spasm in the left lower quadrant and some spasm but less marked in the right lower. There is practically no spasm of the muscles in the upper half of the abdomen. Slight pain is complained of when the hand is passed over the lower half of the abdomen but not in the upper half. Blood pressure, 116/78; Wassermann negative; blood group, Type 1 (Jansky). Urine negative. Stools positive for blood +++, macro- and microscopically. Coagulation time, five minutes; bleeding time, three minutes. Temperature from 99° to occasionally 102° at night; pulse soft, ranging from 90 to 120; respiration 20. Haemoglobin 30 per cent. (Dare); red blood cells 2,152,000; white blood cells 6,400; platelets 365,000; differential count—Polymorphonuclears 56, lymphocytes 44.

All the usual conservative methods were tried to stop the bleeding with the idea of allowing the patient to recover sufficiently to have a thorough X-ray examination of her gastro-intestinal tract made in order to establish by this means if possible the source of the bleeding. Everything was interdicted by mouth and the patient coöperated with us even to the extent of not swallowing her saliva. Fluids were given under the skin and glucose solution was absorbed in fairly large quantities per rectum. As the days went by the amount of blood passed per rectum diminished but was always present.

October 19, or five days after her admission, due to her continued passing of blood per rectum the haemoglobin dropped to 20 per cent. and the red cells to 1,400,000. As the bleeding still continued a transfusion of plus 500 cubic centimetres was given by the direct method October 30 and the same amount was given November 5 and November 24.

As the patient was not gaining, in fact she was losing ground by the conservative treatment, it was decided to perform a probative laparotomy. The only definite thing to guide us in the absence of X-ray evidence was the presence of blood in her stools and its thorough admixture with the stool. This pointed to a lesion very high up in the gastro-intestinal tract and as she did not vomit we reasoned that the lesion was distal to the pylorus. The commonest lesion in this region to give bleeding was an ulcer of the duodenum and with this as a tentative pre-operative diagnosis she was prepared for operation for November 25, 1925.

As already stated a transfusion of plus 500 cubic centimetres of blood was given by the direct method. After a wait of two hours to be sure that no reaction followed, the abdomen was opened under novocain block anaesthesia through an upper right rectus incision. The peritoneum was opened without the escape of any free fluid. The stomach and intestines were found to be markedly anaemic and the former was easily drawn into the wound and thoroughly examined but found to be negative. The duodenum was more fixed and only the first portion could be mobilized. On the anterior aspect a small area was identified as a duodenal ulcer; this was thickened and the peritoneum

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over it on rubbing showed marked stippling. Palpation of the remaining parts of the duodenum as far as was possible with this form of anaesthesia, though limited, was negative. This fact is noteworthy in view of the later findings. We decided to explore the duodenum and excise the small thickened area. An incision was made in the duodenal wall beginning about one inch distal to the pylorus and carrying the incision through the pylorus on to the wall of the stomach for a distance of about two inches, this incision being planned so as to come just to one side of the thickened area and to make its removal a simple procedure. On inspecting the duodenum through this opening nothing else was found except that the site of the thickening of the duodenal wall showed ulceration on the mucous membrane, so this area was excised. Further examination showed nothing abnormal. The closure of the bowel and stomach was done as in a Horsley or Heineke-Mikulicz operation with chromic catgut in three layers. Abdomen closed in layers.

The post-operative convalescence was uneventful and the stools were negative for blood after the first few days and the patient gained in strength. She was discharged December 10, 1925.

The pathological report of the excised ulcer showed "small round-cell infiltration in mucosa and submucosa. At one area there is a gradual destruction first of the superficial glands and then of the deeper glandular structures. This defect is filled in with small round cells and connective tissue."

The patient was seen in March, 1926, and had gained about fifteen pounds in weight. She still complained of some distress with distention after eating but otherwise felt and certainly looked well. She was advised to have an X-ray examination made at this time which was done and except for the distortion of the pylorus it was reported negative.

January 9, 1927, or about thirteen months after her operation, the patient came to see me with the story that she had been bleeding again for about a week and had tarry stools as before the first operation. She was sent to the Lebanon Hospital where her haemoglobin was found to be 48 per cent.

The problem as to what to do for the patient was indeed a serious one. At the previous operation there was still an element of doubt as to whether the small ulcer that was excised had been the actual cause of her having lost the large amounts of blood from her bowel, but the fact that following the operation and for over a year there had been no bleeding was definite evidence that whatever had been done at the first operation was seemingly the cause of the cessation of bleeding. At least it was logical to infer that such was the case. The fact that only the first portion of the duodenum lent itself to thorough examination at the operation under block anaesthesia was a point that left us with the thought that there might be a pathological lesion at a point lower in the bowel but still in the duodenum; the lesion still was considered a possible ulcer that was not palpated at the first exploration, unsatisfactory as it was. In order that no more time would be lost and before the bleeding would lower her haemoglobin to such a point that a general anaesthetic would again be contraindicated it was suggested to the patient that an exploration be done at an early moment under gas-oxygen-ether anaesthesia. The patient accepting this, she was prepared for operation January 13, 1927.

The old scar was excised and the peritoneum opened with no escape of fluid. After freeing the pylorus from a few adhesions the stomach was mobilized easily and found to be free from pathology. The pylorus was rather distorted as the result of the previous plastic but there was no thickening in any part of it. While this was inspected the descending portion of the duodenum was observed to be the site of an apparent intussusception and when the bowel was more closely inspected this was found to be the case—about one inch of the bowel was drawn within itself. At the lower part of the descending portion of the duodenum a mass about the size of a thumb was felt within the lumen of the bowel which was very freely movable. The duodenum in

PAPILLOMA OF THE DUODENUM

this portion was drawn up and opened between traction sutures. This exposed a long papillomatous mass about 6 centimetres long and 3 centimetres wide, parts of which were actively oozing. The base was attached by a pedicle about 1 centimetre across to the posterior wall and upon exerting slight traction was seen to be attached to the mucosa. A few snips of the scissors freed it entirely and a row of chromic gut sutures repaired the rent in the mucosa where it was attached. The rest of the duodenum was normal. Three-layer closure of the duodenal wall followed but the bowel seemed somewhat constricted due to this and the previous operation so a posterior gastro-jejunostomy was done and the abdomen closed in layers.

Convalescence was uneventful and the patient was discharged cured January 28, 1927.

The pathological report was as follows: "Kidney bean shaped mass about 6 by 3 centimetres, firm and glistening, smooth on section and divided into small lobules by connective tissue bands. Section shows islands of adenomatous tissue separated by wide strands of connective tissue. There is infiltration with a moderate number of pus cells. No evidence of malignancy. Diagnosis.—Papillary adenoma with acute inflammatory reaction."

REMARKS

The outstanding facts to be noted in this case other than the comparative rarity of this condition, is the insufficient opportunity afforded in exploring this portion of the bowel under local anaesthesia at the primary operation which did not allow the real source of the bleeding to be palpated. The papilloma we are convinced was present, but owing to its position in a rather fixed portion of the bowel could not be brought up to the palpating fingers.

The X-ray gives a fairly definite picture and should help in the diagnosis when it is obtainable. In the face of active and massive bleeding this might seem to be contraindicated but on careful analysis it seems to us that there is less danger in a well-administered barium meal than there is in exploring the abdomen rather blindly in the hope of finding the source of bleeding. Should the films and fluoroscopy not show the cause of the bleeding definitely, at least the site might be suspected and inspection primarily directed to this area.

Some papillomata have been found in the duodenum when the latter has been opened to remove an impacted calculus in the papilla of Vater and a few which sprang from the mucous membrane about the papilla gave symptoms of jaundice.

A résumé of the symptoms of this case and others reported will show that the outstanding features of this condition are blood appearing in the stools and well mixed with the food residue but without the definite concomitant clinical signs of ulcer, the commonest form of duodenal lesion. Occasionally there is associated with this condition some degree of jaundice.

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New York, N. Y.

BIBLIOGRAPHY

¹ ANNALS OF SURGERY, vol. Ixxxix, No. 1.

² Am. Jour. Rönt. and Radium Therap., vol. xx, No. 5.

BRIEF COMMUNICATIONS

A BONE EXTENSION CLAMP*

FOR the open reduction of fractures of long bones, we know of no instrument which is more simple and effective than the Lane clamp. However, there are times when a leverage action in obtaining extension would be of considerable assistance. In designing the instrument illustrated we have tried to keep in mind simplicity and effectiveness.

Numerous instruments are on the market which undoubtedly facilitate reduction and maintain it while the internal splint is applied, but most of them require too much time in application and take up too much room in the operative field besides being very expensive.

We have taken two Lane clamps, modified them slightly by having a single tooth on each jaw instead of a double tooth, fastened a spring lock bar on

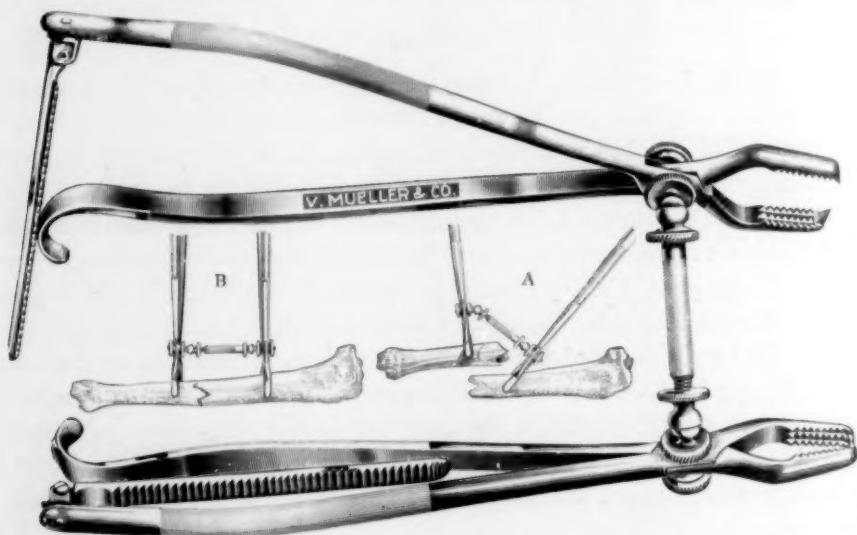


FIG. 1.—Clamps presenting single tooth; gall and socket joints; swivel fulcrum and lock bar.
A.—Showing over-riding of fragments of bone held by clamps at an angle ready for extension. B.—Fracture reduced.

the handles and a fulcrum in the form of a turn buckle with a double ball and socket joint, between the box locks of the two clamps. The single tooth on the jaw of the clamp has the advantage of not tearing the bone and periosteum when extension is applied. For purposes of illustration, we will consider a simple transverse fracture. The upper fragment is grasped by one clamp at an angle of 45° with the handle of the clamp directed away from the fracture, the other clamp is applied to the lower fragment at the opposite angle. The clamps are then locked and the leverage action obtained by forcing the handles together.

This instrument is extremely flexible on account of the ball and socket joints and rotation can easily be accomplished. If a longer fulcrum is desired the swivel bolt is unscrewed, thus lengthening the fulcrum. With the use of

* From the Jackson Clinic.

DECOMPRESSION OF THE HEART

this clamp we are able to overcome any ordinary amount of over-riding. The fragments are easily held while the internal splint is applied and very little room is taken up in the operative field by the instrument. There is no necessity for coming in contact with the wound with anything but the jaws of the clamps. When the lock bars on the clamps are closed, the instrument will stay in position without being held by the operator.

JAMES A. JACKSON, M.D., AND C. KENNETH COOK, M.D.
Madison, Wis.

DECOMPRESSION OF THE HEART

IN THE November, 1929, number of the ANNALS OF SURGERY several articles in honor of the Semi-Centennial Anniversary of the Philadelphia Academy of Surgery appeared. One of these was upon "Decompression of the Heart," by Dr. Evart Graham, of St. Louis, Mo.

Doctor Graham's well-recognized experience and ability in the surgery of the chest, as well as in other branches of surgery, may, I hope, lead physicians and surgeons to appreciate the advantages to be gained by early resort to decompression of the heart in suitable cases before the organ is worn out in its struggle to function in a too-narrow cage.

Although my own experience is limited to three cases in which the operation was primarily designed to untether a hypertrophied, much crippled heart by mediastino-pericarditis, yet, in a paper written in conjunction with Dr. A. D. Dunn,¹ of Omaha, we expressly stated, as Alexander Morrison² had advocated and practised the removal of several overlying ribs to allow the heart freer play in a case of cor bovinum, that "the freer play afforded the greatly hypertrophied and dilated heart by the operation was noted in our case. The correctness of Morrison's reasoning must be determined by extensive clinical application of this theory. We would suggest the term Cardiac Decompression in place of Thoracostomy as used by Morrison, because it better describes the import of the operation."

Those particularly interested in the subject may find the sphygmographic and cardiographic tracings made both before and after operation on this patient and other data from the literature in our paper. The man lived four and one-half years after operation and should perhaps be living today had we been able to control his habits and activities.

Further notes on this case and another may be found in *Surgery, Gynecology and Obstetrics*, July, 1917, pp. 92-95.

Doctor Graham noted in the technic carried out upon his patients that a sub-periosteal resection of the ribs was made as well as that the periosteum and perichondrium were stripped off the pleura. All of this I regard as essential in order to obtain the substitution of a soft tissue covering for the heart without the constant hammering of the chest wall. I would like again to state that in our paper we wrote: "The purpose of the operation was

BRIEF COMMUNICATIONS

not only to untether the heart by doing away with the costo-pericardial adhesions, but also to give the enlarged organ room for free play."

Doctor Graham's second case may possibly be considered as coming within the scope of pathology for which Morrison recommended operation—the child survived the operation three months. The first case can hardly be considered of that type, the early post-operative death (five months) and the autopsy findings would indicate great crippling of a much damaged hypertrophied heart.

The obliteration of both pleural spaces and that of the pericardial cavity by dense fibrous adhesions and the attachment of the pericardium to the thoracic wall, taken together with the findings of the heart walls and its cavities, scarcely place the first case within a class suitable for any surgical procedure.

"A chronic adhesive pleurisy, as is well known, becomes a factor of no little importance in a circulatory problem, in which the work to be done approximates the power available." (Dunn-Summers.) There are unquestionably "many inviting problems" to be considered when taking under advisement decompression of the heart. We will have to present better evidence of the advisability of operation, in embarrassed cardiac hypertrophy in particular, to induce physicians to change their usual management of the pathology of this important organ.

JOHN E. SUMMERS, M.D.
Omaha, Nebraska

BIBLIOGRAPHY

¹ Observations on a Case of Mediastino-pericarditis Treated by Cardiolysis (Brauer)
Amer. Jour. Med. Sciences, Jan., 1913.

² Lancet, July 4, 1908; November 20, 1909.

GALL-STONES IN THE DUODENUM

THE report of the following case is offered for publication because: (1) of the absence of obstructive symptoms despite the fact that the duodenum was practically occluded by stones; (2) the lack of any fistulous opening, or a scar, between the gall-bladder and duodenum; (3) the rarity of similar cases reported in the literature.^{1, 2}

The patient, a woman, age sixty years, was first seen by me September 24, 1928. For two years she had been suffering with symptoms indicating gall-stones. They were characterized by pain in the epigastrium radiating to the right shoulder; nausea and vomiting, associated with jaundice. Vomited often during and after these acute attacks. Tenderness and some rigidity over epigastrium. When first seen she seemed too ill to consider surgery. She remained under treatment for eleven days and was then discharged under the care of her family physician.

Two and one-half months later she returned to the hospital. She had had no attacks of severe pain since her previous admission although there was still some tenderness over the gall-bladder. No history of constipation. She had dieted for the two and one-half months because eating caused discomfort and some pain in the epigastrium. She had lost forty pounds, which she attributed to the diet, but her general

METHOD OF CUTTING A SMALL DEEP GRAFT

condition was much improved; renal function at this time being 40-15-55, blood count normal, blood urea 14 milligrams, NPN 33.6 milligrams. Urine contained 20 milligrams of albumin but no casts.

She was observed for four days and operated upon on the fifth day, December 14, 1928.

Under ether anaesthesia upper right rectus incision was made exposing the pyloric end of the stomach, together with omentum, adherent to the gall-bladder. These adhesions were liberated and a very hard irregular mass was palpated in the first portion of the duodenum, immediately below the pylorus. One area the size of a ten-cent piece was very black. An incision was made just inferior to the pyloric sphincter, and ten moderately-sized gall-stones were removed from the first portion of the duodenum, where they had been tightly packed against the pylorus. Careful investigation was then made of both the gall-bladder and duodenum and there was no evidence of any fistulous opening, or of a scar, between these two structures. The duodenum was then closed in the usual manner. The gall-bladder was opened and one moderately-sized stone found in it was removed. Palpation revealed two stones in the common duct. The gall-bladder was split and an incision made into the common duct and the stones in the latter structure removed. One rubber tube was then placed in the common duct, the end pointing toward the liver; the common duct was sutured about the tube. A large portion, three-fourths, of the gall-bladder, was then removed and the remaining portion approximated around the rubber tube placed in the common duct. The usual accessory drainage was instituted. A portion of the omentum and peritoneal flap was then sutured over the incision previously made in the duodenum, thus affecting a complete peritonealization of this raw surface as well as reinforcing it. The incision was closed in the usual manner.

The patient entered an uneventful convalescence and left the hospital on the fifteenth post-operative day. At the present time she is well, has no complaints and is able to pursue her household duties.

PAUL D. SCOFIELD, M.D.

Columbus, Ohio

From the service of Dr. R. B. Drury at the Grant Hospital.

BIBLIOGRAPHY

¹ Thompson, James E.: Complete Obstruction of the Duodenum Resulting from the Impaction of a Large Gall-stone, *Surg., Gynec. and Obst.*, Chicago, vol. xv, pp. 267-272, 1912.

² McWhorter, Golder L.: Acute Obstruction of Small Intestine Due to a Gallstone, *Arch. of Surg.*, vol. xviii, pp. 915-921, 1929.

THE SMALL DEEP GRAFT

IN AN article on "The Small Deep Graft" published in the *ANNALS OF SURGERY*, June, 1929, page 902, the enlarged photographs used to illustrate the technic of cutting this type of graft did not reproduce as well as was expected. In consequence, there has been some confusion in following the legends and a number of inquiries have come to me about the matter. In order that the steps in the process might be made perfectly clear, Max Broedel has been good enough to make for me some excellent drawings which beautifully illustrate the procedure. These follow:

BRIEF COMMUNICATIONS

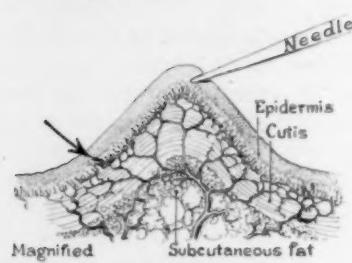


FIG. 1.

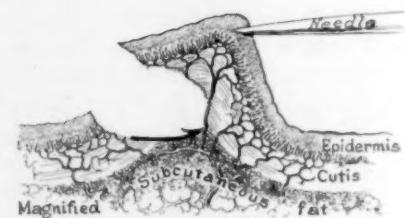


FIG. 2.

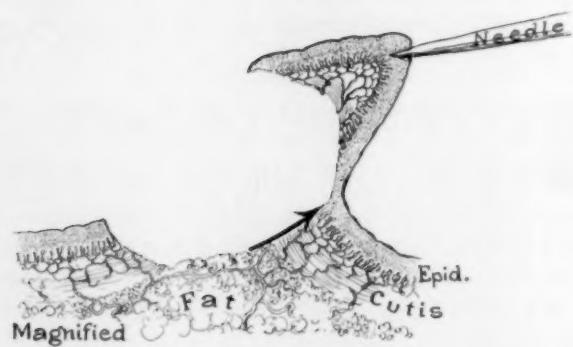


FIG. 3.

METHOD OF CUTTING A SMALL DEEP GRAFT

FIG. 1.—Shows the point of a needle held in an artery clamp lifting up a little cone of skin. Note the edge of the knife against the base of the cone with the blade tilted slightly downward.

The insert is a schematic drawing, magnified to scale, of the cone of skin raised by the needle. The black arrow indicates the direction and tilt of the blade in cutting through the first half of the base of the cone.

FIG. 2.—Shows the graft cut halfway through. The tilting of the knife blade downward as far as the center of the graft will usually include the full thickness of the corium at that point.

The insert is a schematic drawing, magnified to scale, which shows the details of the small deep graft cut halfway through the base of the cone. The black arrow indicates the upward tilt of the blade which begins at that point.

FIG. 3.—Shows the position of the knife blade tilted upward as it almost completes cutting the second half of the graft. It will be noted that the process in cutting the second half is reversed, the blade going from the thick center upward and outward to the thin margin.

The appearance of a graft after it is completely cut and still on the needle is shown. The graft should not be more than .5 centimetre in diameter. The central portion is much thicker than the margins. Note the wound from which the graft is cut, especially the little area of fat which can be seen in the central portion of the pit, which indicates that the full thickness of the corium is included in the graft at that point.

The insert is a schematic drawing, magnified to scale, which shows the details of the process in cutting the second half of the graft. The black arrow indicates the upward and outward tilt of the blade at a point just before the separation is completed.

FIG. 4.—Showing the relative thickness of a Reverdin graft as compared with a small deep graft.

Schematic drawing, magnified to scale, which shows a cone of skin raised by a needle just as if a small deep graft were to be cut. In order to cut a Reverdin graft, the knife blade is held flat at the level through which the tip of the cone is to be cut across, and the direction and level is indicated by the upper arrow. In this way by cutting close to the needle the thinnest type of graft can be removed, and this is the true Reverdin graft. Note that only the epidermis and a portion of the papillæ of the corium are included. Compare the thickness of the Reverdin graft with that of the small deep graft, whose outline is indicated by the three black arrows.

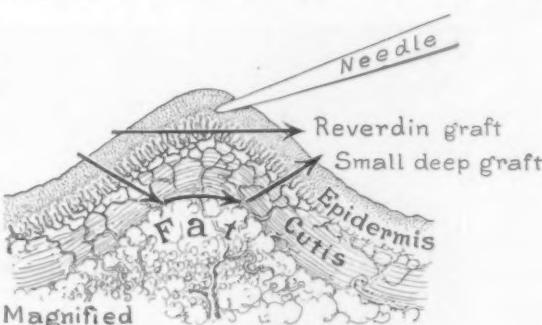
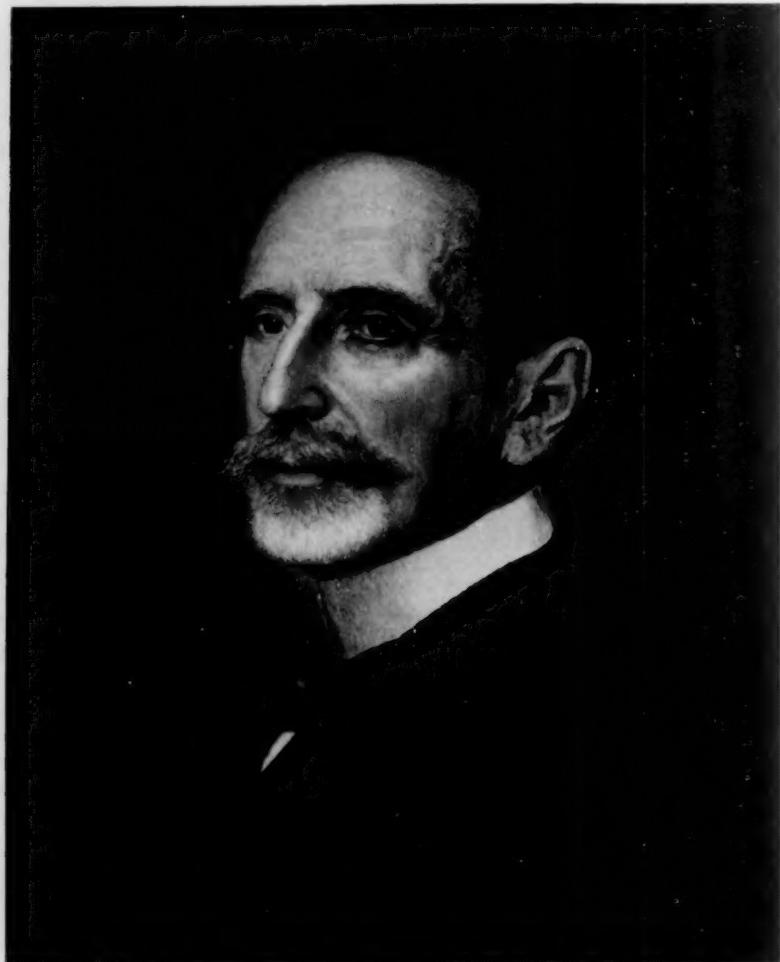


FIG. 4.

JOHN STAIGE DAVIS, M.D.
Baltimore, Md.

MEMOIRS
THEODORE TUFFIER
1857-1929

A REVIEW of Tuffier's surgical activity is a complete history of the surgical art in the last forty years. At every stage we find the scholar, the innovator,



THEODORE TUFFIER, M.D.

the teacher. Particularly did he comprehend the importance of experimental surgery.

His ancestry was fine old peasant stock. His talents and industry were obvious from the start of his medical career, Interne, 1879; Attending Sur-

THEODORE TUFFIER

geon to the Hospitals, 1887; and Professeur agrégé, 1889, when he immediately made a reputation as a brilliant teacher of external pathology. His hospitals were the Pitié, Lariboisière, and Beaujon. His services were a shrine for the surgical pilgrims from all over the world.

Among his notable achievements was his war record. From 1914 to 1918 he devoted all his activities to the war surgery, especially of the front. He became Inspector General of the Surgical Services of the Armies. He was particularly active in putting into force the Carrel method and later the excision of wounds. He was President of the French Section of the Interallied Surgical Conference of which he was one of the founders and to which he made a series of important reports on the problems of war surgery.

Tuffier's eminent services during the war were rewarded by the order of Commander of the Legion of Honor, and subsequently in 1925 by the Grand Cross and by the Croix de Guerre, with a citation at the order of the Army, "Surgeon of the highest accomplishments. Although not under any military obligations has given to the Armies from October, 1914, to the end of the war the coöperation of his science and particularly in the great military operations of Champagne, Verdun, Somme, Flanders, l'Aisne and the Marne." Grand Headquarters, February, 1919, Maréchal Pétain.

In 1925, the occasion of the Third International Congress of Medicine and Pharmacy, his former pupils and friends celebrated his jubilee under the Presidency of Maréchal Joffre.

Besides innumerable honors received from his own countrymen, he was awarded many from other governments. Of all these distinctions none was more dear to him than the Distinguished Service Medal of the United States which members of this Association joined in demanding for him.

Many members of this Association will remember gratefully the tremendous interest he took in their operations in France and the invaluable help he gave them in familiarizing themselves with the best and most important methods. At his delightful home with his family he kept open house for these Americans, many of them weary from work at the front.

Tuffier was an interesting and brilliant personality, of fine presence, a clear, logical and interesting speaker, of broad culture, well read and interested in philosophy and art. He was also a great traveller and made three trips to the United States, where he had a host of devoted friends. He also made a trip around the world on the occasion of his going to take part in the opening of the Pekin Union Medical College. He was elected an Honorary Fellow of the American Surgical Association in 1918.

"From the consideration of this active and fertile life one learns the lesson that life is accomplishment; that the man of action does not really die but his work goes on." (Rouvillois, Commemorative Session, Academy of Medicine.)

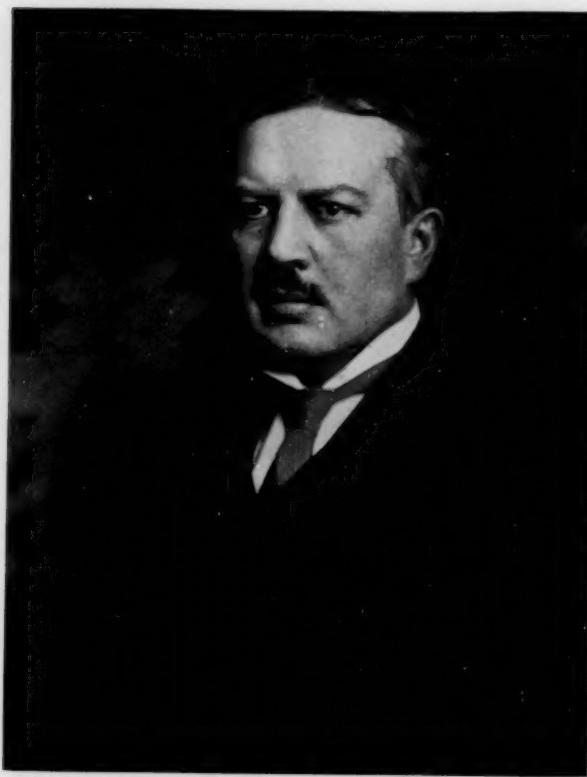
CHAS. L. GIBSON.

CARL A. HAMANN

1868-1930

IN THE early 'nineties the medical profession of Cleveland as well as the Medical School of the Western Reserve University received a vital impulse due to the new blood infused into the medical faculty. This impulse soon created an epoch in medicine whose influence has been felt throughout the

field of medical science. The principal figures in this drama were Hamann, Hoover, Stewart, Howard and Robb. The intellectual and personal force of these personalities coupled with the endowments provided by generous Clevelanders, notably Samuel Mather, Esq., and H. M. Hanna, Esq., created a medical epoch. Emerging from this forceful group Hamann came to the front as the leader in the important office of Dean. The names of Hamann and Hoover will have a permanent place in the history of clinical medicine in Cleveland, especially at the City Hospital which they converted into a great scientific institution.



CARL A. HAMANN, M.D.

A keen mind, tireless energy and a trust-inspiring personality soon gave Hamann such great professional responsibilities that the load was more than a single individual should carry. Added to his clinical activities was his work as an anatomist and a teacher; and in addition to all the rest were the exacting duties of his position as Dean of the Medical School. These influences brought him early recognition by the American Surgical Association, to Fellowship in which he was elected in 1909.

The American Surgical Association appreciates the high qualities of this master surgeon and great teacher. Modest, retiring and humble though he was, he nevertheless made a lasting impression on thousands of students who

CARL A. HAMANN

have been his pupils; and upon his colleagues who admired his technical wizardry, keen judgment and surgical temerity.

In his chosen field of applied anatomy he was unexcelled. Rarely is it given to one man to be equally a master in two fields but Doctor Hamann was no less a Surgeon than an Anatomist; no less an Anatomist than a Surgeon. He did not seek friendships; but nevertheless Doctor Hamann gained to an astonishing degree the affection and devotion of his students and co-workers, especially in the hospital of which he was for so many years affectionately termed the "King."

That his papers and discussions and his personality carried weight in this Association is evidenced by his elevation to the office of Vice-president in 1929. The Officers and Fellows will remember him as a great surgeon, and a lovable, kindly personality.

GEO. W. CRILE.

ERRATA

In the February issue of THE ANNALS OF SURGERY the Memoir of

Francis Wisner Murray, M.D.

should have been dated 1855-1929 instead of 1873-1929.

EDITORIAL ADDRESS

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